73 Amateur Radio Today

JUNE 1995
ISSUE # 417
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CANADA $4.95
A WGI Publication
International Edition

SUPER CW STATION!

THE N4UAU
73 DE N4UAU !
M=TONE S=CODE R=80CHR P=KEY
SUPER CW
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RESET
M
S
R
PADDLE
SIDETONE
VOL

BUILD YOUR OWN . . .

Battery Monitor & Charge Controller

Tone Burst Generator

Morse Code Keyer

2m 5/8-Wave Collinear Omni Antenna

73 Reviews

AEA KK-1 Keyer

SGC Longwire Antenna Tuner

Swiech Yagi

Expand Your Horizons to 6 Meters!

NEW from ICOM

IC-736: 6 Meters and HF!

☐ HF and 6 Meters!
☐ 100 W Output for Both HF and 50 MHz
☐ Internal AC Power Supply
☐ Automatic Antenna Tuner (Covers 6 M to 160 M)
☐ Dual Antenna System
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☐ Quick Split Function (with pre-programmable offset)
☐ MOS-FET "Class A" Audio
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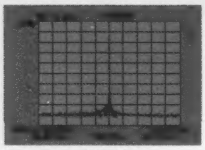
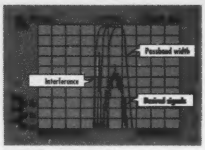
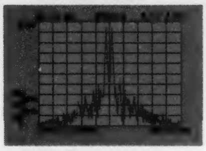
☐ Selectable Filters
☐ 10 dB Pre-amp, 20 dB Attenuator
☐ Built-in Electronic Keyer
☐ RIT, ΔTx, ΔRx
☐ 10 Key Pad
☐ VOX
☐ RF Gain
☐ 101 Memory Channels
☐ Passband Tuning
☐ AF-type Speech Compressor
☐ CW Full Break-In
☐ Notch Filter
☐ Noise Blanker
☐ Large Display



Transmitter C/N Ratio



PBT Characteristics



3rd IMD Characteristics

Now you can work all of the HF bands AND have access to one of the most exciting amateur bands – 6 M! The IC-736 is an all band, all mode transceiver with a general coverage receiver. Only an antenna, coaxial cable and AC outlet are necessary to get up-and-running with this rig. Cutting edge features and "plug 'n play" operation make the IC-736 a "complete station in a box!"

The IC-736's compact and cleverly designed **Automatic Antenna Tuner** has preset memories for each 100 kHz step, thereby providing very high speed tuning. Tunes all ham bands plus 6 M!

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CW fans will love the IC-736. The **Full Break-In Function** (QSK) allows you to receive signals between transmitted keying pulses (semi break-in is also available). **Separately Designed CW Key Jacks** allow you to connect both a memory keyer and a paddle – great for contest operation!

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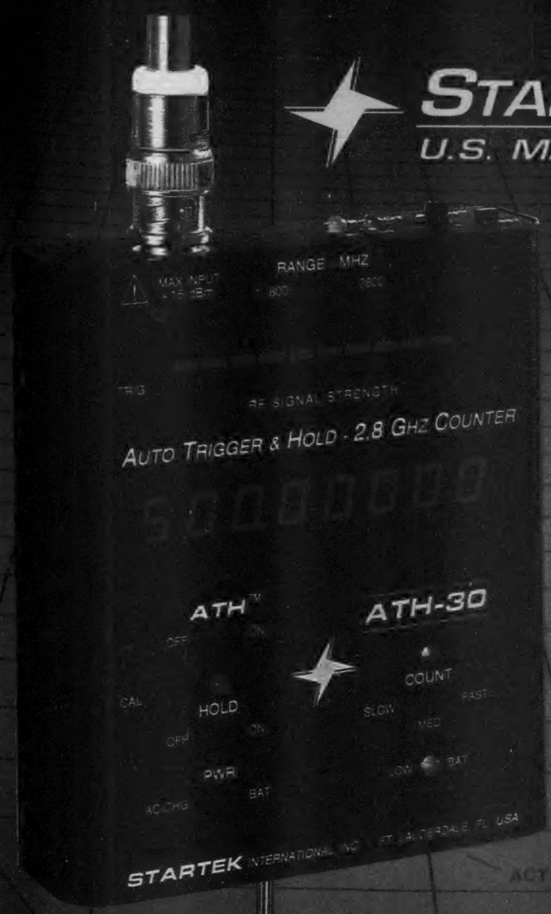

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ATH-10
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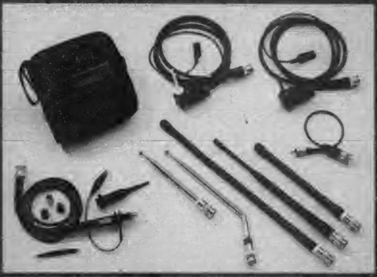

Some Accessories Not Pictured

ACCESSORIES

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#TA-90	Telescope BNC Antenna	12
#TA-90-L	Telescope Elbow BNC Antenna	16
#RD-150	150 MHZ Rubber Duck Antenna	16
#RD-2750	27 & 50 MHZ Rubber Duck Antenna	19
#RD-450	450 MHZ Rubber Duck Antenna	16
#RD-800	Cellular phone band RD Antenna	16
#P-110	200 MHZ 1X-10X Probe	39
#LP-22	Low Pass, Audio Probe	25
#DC-10	Direct, 50 OHM Probe	20
#DC-5	BNC Cable to Clip Leads	12
#M-207-IC	Interface Cable MFJ Ant. Analyzers	10
#APA-9	9VDC Auto Power Adapter	6

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The DX-70T operates 160 through 6 meters, includes general coverage reception, dual VFOs, 100 tunable memories, and 38 CTCSS tones for 6 and 10 meter FMing. It also has IF shift, wide and narrow CW filters, selectable semi and full CW break-in,RF preamp, attenuator and high performance noise blanker---all built in! Alinco's DX-70T puts you on top of all the action!

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The easy-to-operate DX-70T is an outstanding performer, exceptionally reliable and backed with a full one year warranty. Your total enjoyment is guaranteed!

Features

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- Power Output:
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  - (10 watts low, 40watts AM)
  - 50-54 MHz: SSB, CW
  - FM: 10 watts (4watts AM)
- Dual VFOs
- 100 tunable memory channels
- Semi and full CW break-in
- Wide and narrow/500Hz CW filters included
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- Noise Blanker
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This device has not been approved by the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased until the approval of the FCC has been obtained.

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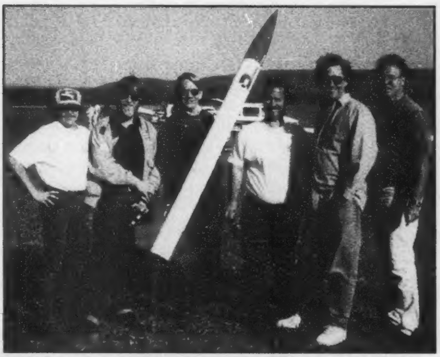

These guys are preparing to launch an ATV rocket that will eventually land amidst a herd of cows. See page 64 for the details.

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FEEDBACK...
FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK list on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best.

On the cover: This ain't no ordinary, run of the mill keyer. Nope. It's a Super CW Station, complete with clock, calendar, alarm (it alerts you with your own CW messages), Morse code reader, keyer with adjustable sidetone, random Morse code practice generator . . . and more. And you can build it! Tune in to page 10 for details.

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Subscription Services
1-800-677-8838

Foreign Subscribers
1-609-461-8432

Reprints: $3.00 per article.
Back issues: $4.00 each.

Write to *73 Amateur Radio Today*, Reprints, 70 Route 202N, Peterborough, NH 03458.

Printed in the U.S.A. by Quad Graphics, Thomaston, Georgia.

Editorial Offices
70 Route 202N
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phone: 603-924-0058

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Peterborough NH 03458
phone: 800-274-7373

Circulation Offices
70 Route 202N
Peterborough NH 03458
phone: 603-924-0058

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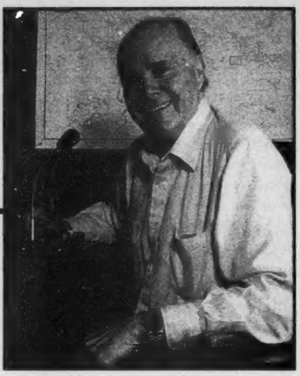
73 Amateur Radio Today (ISSN 1052-2522) is published monthly by Wayne Green Inc., 70 Route 202 North, Peterborough NH 03458. Entire contents ©1995 by Wayne Green Inc. No part of this publication may be reproduced without written permisson of the publisher. For Subscription Services, write to *73 Amateur Radio Today*, P.O. Box 7693, Riverton NJ 08077-7693, or call 1-800-289-0388. The subscription rate is: one year $24.97, two years $39.97; Canada: $34.21 for one year, $57.75 for two years, including postage and 7% GST. Foreign postage: $19.00 surface or $42.00 airmail additional per year. All foreign orders must be accompanied by payment in US funds. Second class postage paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm Edition—University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, P.O. Box 7693, Riverton NJ 08077-7693.

Contract: Even the most cursory glance at this text is sufficient to bind you, morally and legally, to take a kid (or kids) along on Field Day, get 'em fired up on amateur radio, and then help 'em get started toward a license. You'll feel good about yourself, and our legal counsel won't have to hassle you.—Nuge WB8GLQ

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



DXpedition, Anyone?

Well, perhaps that's an exaggeration. What I have in mind is a 25-day whirlwind visit to several Pacific islands for some hamming and scuba diving. Any divers with this November to spare for a trip?

The plans are to fly to Majuro first, spend a couple days hamming and diving, then on to Pohnpei for four days of same. Then to Truk for four more days, Yap for three days, and Palau for three days. Well, I said it was a whirlwind trip. But that should be enough to get in 16 days of diving and hamming and nine days traveling.

Some time ago, egged on by Robbie 5Z4ERR, I planned an African hunting safari, followed by a trip on around the world (which didn't cost much more than just flying back), I managed to talk two other hams into going along. We all had a ball! I'm editing the report I wrote on that trip, and I've got a ton of photos to go with it. That'll make a book all by itself. I ran into Jim Cotten recently and he said that that was the trip of his lifetime.

Yes, we shot game in Kenya. We had a great visit to Uganda. And Afghanistan, Iran, Iraq, and so on. I got on the air everywhere I could . . . like Lebanon, Kenya, Iran, Nepal, Syria, India, Singapore, Tahiti, and so on. This time I'll be visiting six Pacific countries and I'd love to have the company of a couple of ham-divers. You've got to be good divers. This stuff isn't for sissies. My wife Sherry will be with us, but she doesn't dive.

If you know or run across any hams who are active on these islands, please let me know so we might be able to use their stations instead of our having to lug a ham rig all over the Pacific. I'll have enough to carry with all my diving equipment and my underwater video camera. We'll be stopping in Honolulu and Guam overnight, if there are any ham clubs who'd like to get together with me (or us).

So, anyone with a few weeks available who'd like to bask on some Pacific islands with me? If you've read any of my travel reports you know that Sherry and I travel cheap.

Stop That Noise!

Yes, it's opportunity knocking again. The noise is getting on our nerves as we get pushed and shoved, our heels gouging long tracks, further into the vaunted information age.

Here we are, looked upon by what few of the public have even heard of amateur radio, as communications and electronics experts. If they only knew! Well, I'm not going to tell them that one of our main preoccupations these days is in trying to return to the womb. Our Newington-based leadership, heads firmly planted in the sand, are frantically hanging on to the code as a way to keep new hams out of their preserves. Ham radio started with spark transmitters, and they used the Continental Code to communicate, since voice couldn't be modulated on a spark transmitter. "Spark Forever," was the old-timer's cry of the 1920s. That cry hasn't changed much. Now it's "CW Forever!"

Let's be practical about this. If you were a teenager today you would be reading about the Internet, seeing ads everywhere for CompuServe, and be getting free disks and a few free hours of connect time to get on America On-Line and Prodigy. With a modem you'd soon find yourself chatting with people almost anywhere in the world, and all in real time. No QRM, no lousy band conditions. No tower, beam and kilowatt rig needed.

Ham radio? Isn't that something like CB? When is the last time you saw an article in a major magazine about amateur radio? Oh, we make the newspapers here and there, now and then. But that doesn't compete with the Nintendo and Sega ads. It doesn't mean much compared to the online services stories we see every week in almost every news magazine.

Yes, I'm critical of our *only* national organization refusing to spend some of the millions of dollars they've squirreled away for a rainy day, while completely ignoring the storm clouds gathering. We need a well-planned national promotion of amateur radio, with articles by well-known hams in the major mass magazines, on the radio, and on television. We need to organize national amateur radio events.

I'm not talking about spending a zillion dollars either. Public relations (PR) is the cheapest form of advertising there is. I've a $50 video I made showing how any company can generate an extra million dollar in sales for peanuts, just with the intelligent use of PR.

We have a ton of things to tell the public, it's just that we have no organization that's doing anything about it. That nine-year-old Extra Class girl should have at least been on the Today Show. Ham DXpeditions would make fascinating articles for travel magazines as well as the general media. If we had one retired professional PR ham we could turn loose, that's all it would take.

I hired an experienced PR chap a few years ago and he had no problem in getting me on the radio and TV with one interview after the other. He had me speaking to Lion's Clubs, Kiwanis, Rotary Clubs, Chambers of Commerce, and lecturing at Yale, Boston University, and a bunch of other colleges. A good PR person can call up the networks and get through to the right people.

We'll start attracting new hams if we mount a national promotion for amateur radio. Without it we're going to keep on being virtually unknown. If you don't agree with me that we should aim for at least five million hams, I'd like to know why. As I've pointed out, we are at present using less than 0.13% of our ham bands on any kind of a regular basis. Do you think for a minute that the FCC isn't well aware that we are a bunch of doddering old white men with the private use of billions of dollars in spectrum?

So what do we do? We keep poking the Commissioners in the eye with a pointed stick, wringing our hands over Baxter and his stupid ego trip, over repeater wars, bad language on 14,313, and other idiocies. And in case the Commissioners don't get the message, we also complain to our Senators and Congressmen, knowing they haven't a clue as to what amateur radio is, and will merely forward the complaints along to the FCC, adding to their frustration with us.

I am old enough so I can remember when the public knew what amateur radio was and there was prestige in being a ham operator. Yes, I have a long memory. Now I'm afraid that I may outlive amateur radio. Will we even have a hobby in 10 years? I'd put the odds at around 20% right now.

I hate to keep saying the same thing over and over, but our country needs amateur radio desperately. We need to get our kids fired up when they are around 10 years old and thus encourage them to learn about electronics and communications because it's fun. In that way we'll have the high-tech career workers our country is going to need to compete in the 21st century.

If you are an ARRL member I wish you'd demand that they set up a PR office and get a national campaign started. Tell 'em that if they don't, you'll let your membership drop. Their magazine is good, but you can buy it on newsstands without being a member. And if you aren't a member, tell 'em you might consider membership if they were doing the job you expect of them.

They should be getting Jean Shepherd (K2ORS) to write humorous ham stories for *Playboy.* He won their humor award several years running with his stories, but they weren't about ham radio. And how about getting Andy Griffith, Barry Goldwater, and so on to help promote us? Or should we get Kevin Mitnick to write? He'll probably be in prison for a few years and have plenty of time.

Oh yes, I started to write about opportunities and got off, as usual, on a tangent.

The so-called information highway is more like an information garbage dump. Sure, there's tons of great information there to be found. The problem is finding it. And where there's a problem, there's an opportunity. You might start out by doing some articles for *73* on where and how to access ham radio groups on the Internet. With some organization we might end up with 73 different groups, one for each of the separate aspects of the hobby. For instance, the 80m DX crowd could use a QRM-free resource to get and give information about 80m DXing. Wouldn't it be nice to have a source for the calls and frequencies for hams around the world sending high-definition color pictures by slow-scan?

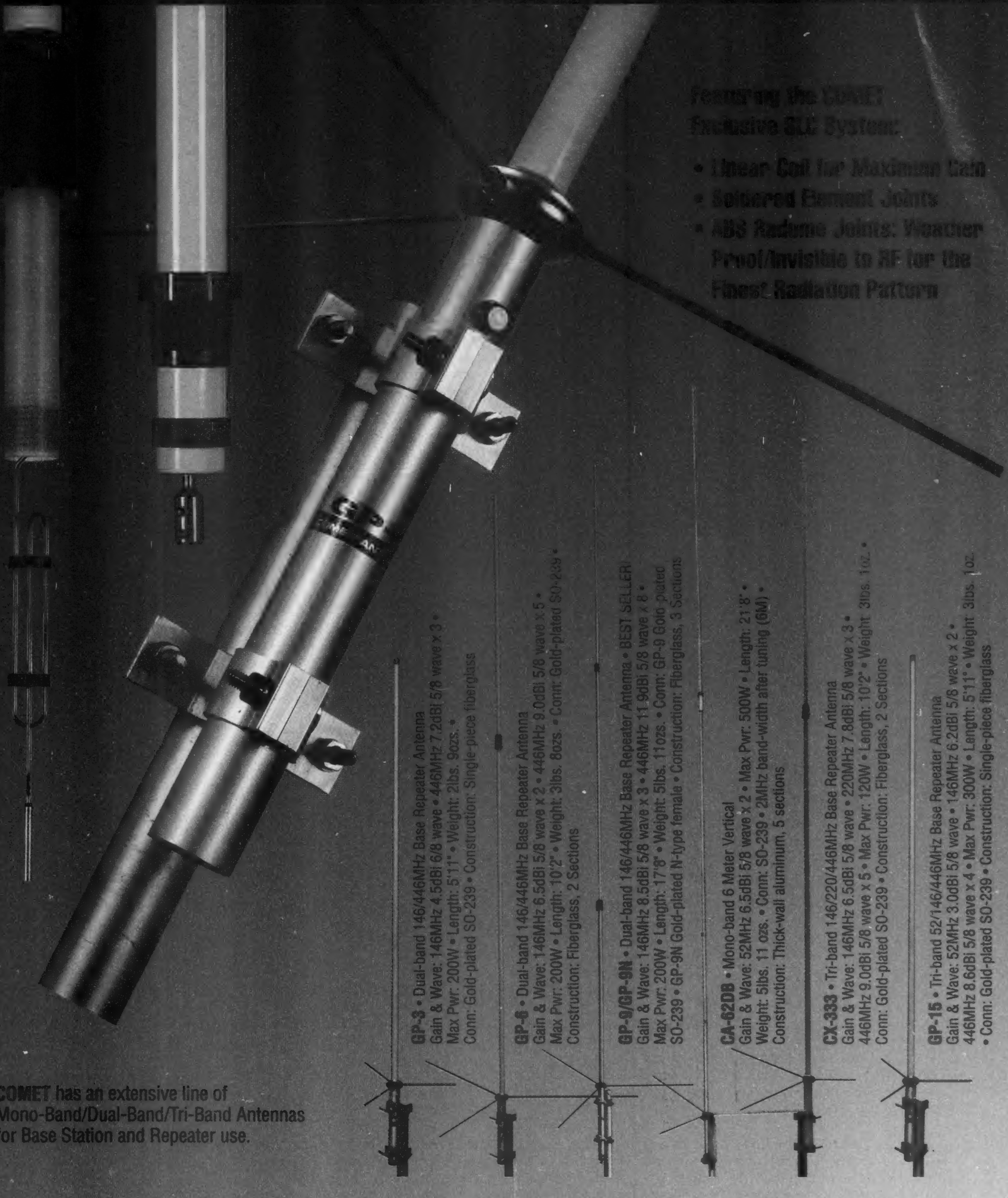
Hams could use the Internet to set up schedules for DXing, RTTY contacts, and so on.

There is going to be a long battle for on-ramps to the information highway. As users, we don't care if we use the telephone wires, cable, a local repeater, or a satellite dish. We do want to know what the pros and cons are of each system, and how we can best adapt to them. I'm expecting some articles.

Newcomers to the Internet are buying books by the ton to help them cope with this huge information garbage dump. They're looking for someone who knows his way through the forest to help guide them. That's an opportunity.

Will I be able to say in 10 years that I knew the top people involved, as I can say of computers? That's all up to you. If you prefer watching Murphy Brown and ball games on TV to making things happen, you'll never be a Bill Gates or a Steve Jobs. It's your choice. Take your ear plugs out and see what opportunity has to offer when you open the door.

Continued on page 74



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Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass

GP-6 • Dual-band 146/446MHz Base Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave x 2 • 446MHz 9.0dBi 5/8 wave x 5 •
Max Pwr: 200W • Length: 10'2" • Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 •
Construction: Fiberglass, 2 Sections

GP-9/GP-9N • Dual-band 146/446MHz Base Repeater Antenna • BEST SELLER!
Gain & Wave: 146MHz 8.5dBi 5/8 wave x 3 • 446MHz 11.9dBi 5/8 wave x 8 •
Max Pwr: 200W • Length: 17'8" • Weight: 5lbs. 11ozs. • Conn: GP-9 Gold-plated
SO-239 • GP-9N Gold-plated N-type female • Construction: Fiberglass, 3 Sections

CA-62DB • Mono-band 6 Meter Vertical
Gain & Wave: 52MHz 6.5dBi 5/8 wave x 2 • Max Pwr: 500W • Length: 21'8" •
Weight: 5lbs. 11 ozs. • Conn: SO-239 • 2MHz band-width after tuning (6M) •
Construction: Thick-wall aluminum, 5 sections

CX-333 • Tri-band 146/220/446MHz Base Repeater Antenna
Gain & Wave: 146MHz 6.5dBi 5/8 wave • 220MHz 7.8dBi 5/8 wave x 3 •
446MHz 9.0dBi 5/8 wave x 5 • Max Pwr: 120W • Length: 10'2" • Weight: 3lbs. 1oz. •
Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

GP-15 • Tri-band 52/146/446MHz Base Repeater Antenna
Gain & Wave: 52MHz 3.0dBi 5/8 wave • 146MHz 6.2dBi 5/8 wave x 2 •
446MHz 8.6dBi 5/8 wave x 4 • Max Pwr: 300W • Length: 5'11" • Weight: 3lbs. 1oz.
• Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass

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LETTERS

Number 2 on your Feedback card

From the Ham Shack

Clayton Schmitt N7DKZ/HP3, David, Chiriqui, Panama Wayne, although you're not aware of it, our association predates the time when *73 Magazine* sold for 37 cents. I've followed your editorials and capitulated to most of your prodding over the years. At your insistence I've gone RTTY, SSB, FM, QRP, repeaters and much more. Also, I have enjoyed building a sizable number of your construction projects.

I started out almost 50 years ago as W0KTX and over the years have been KL7GDQ, WB7ETO, and now N7DKZ. I am retired and live in David, Chiriqui, Panama.

I would like to present you with an idea for *73*. Over the years you've had myriad excellent articles in *73*. Due to a number of moves during my professional career, I have had to give away my library of *73* magazines several times, always shedding tears the approximate size of elephant fecal matter. I know that the entire life span of *73* is available on microfilm. This is an excellent media, but it does present problems. Copying an article or a schematic is not the easiest thing to do. This leaves you with the option of drawing free-hand, with all the accompanying errors, or doing without. Plus, the microfilm reader is a pain.

I assume that you have retained the publication rights for the entire life of *73*. Since you are already in the CD-ROM publication business, why not put *73* on CD-ROMs? Possibly you have sufficient articles on such topics as antennas to market an entire CD-ROM on the subject. Or, combining antennas with QRP and other subjects would be sufficient to fill a diskette. As a last option, republish the entire life span of *73* on CD-ROMs. I assume your supply of editorials would be sufficient to fill several CD-ROMs.

Another suggestion, if I may: Why not code new listings in Uncle Wayne's Bookshelf with an asterisk or something? This would make it convenient to keep up on new publications that you have for sale. I would still have to read your entire listing on, say, antennas if I wanted to buy an antenna reference book.

A last suggestion, then I will sign off: Reorient your editorials to ham related subjects. When I buy a ham magazine I couldn't care less about UFOs, ESP, NDE, cold fusion, or regular reruns of your trials and tribulations in the music publishing business. I want to be fully informed on the latest state of the art in ham radio. The other subjects generally turn me off.

With that I'll go back to helping members of the local ham radio club construct 2 meter antennas based on the "Copper Dual-Band Super J-Pole Antenna" described in KA0NAN's article in the April 1993 issue. Since I pay full price for my *73* subscription, I'm fully entitled to my opinion. I think *73* is a great magazine; however, your editorials burn up a lot of valuable space. Thanks for hearing me out.

Clayton—Go suck eggs ... Wayne

Paul Chapio KK5EF, Stephenville TX Wayne, Bravo on your "Never Say Die" column! My wife and I just returned from a trip to Malaysia and Singapore on a shoestring budget and had a ball. I highly recommend the mountainous areas of Malaysia, such as Cameron Highlands and Frazier's Hill.

I heartily agree with your challenge to people to explore and "get off their duffs." My wife takes care of six neglected and abused boys as our "job." With our small salary (albeit other immeasurable rewards), we surely have more fun than people earning multiples of our combined salaries. I am currently starting a radio club for our boys (if I may put in a plug—we need equipment). I feel that you and I are kindred spirits as I also have an entrepreneurial bent (I produced corporate videos for Fortune 500 companies in my previous life, before I "cashed out") and an appreciation of the arts, especially music. (I earned a B.A. in music while pursuing another degree because I was so fascinated by music—dual degrees!)

Anyway, my reason for writing is to express my opinions on the topic of boring QSOs. It seems a parallel exists in the arts. While pursuing my Master of Fine Arts degree, I had a professor named Charles Werberig at RIT in Rochester, New York, who had an exercise for graduate students who became too entangled in the *technology*. He would make them set down their Nikons, Sinar view cameras, digital light meters, and Zone System, and use a cheap plastic, non-focusable, non-adjustable camera called a Diana. The assignment: "Go out and shoot what is *important* to you!"

You see, we all stand the chance of becoming technicians, even in the arts. Amateur radio trains technicians, not effective or creative communicators. It's as though we've taught people to operate, troubleshoot, and even build their own printing presses, but they have nothing to say in print! My personal viewpoint is that the dilemma is beyond the scope of amateur radio—it's a people issue. People wishing to become more effective communicators can read more, go to journalism school, take creative writing courses, or practice art. But as long as the *Amateur Radio Handbook* remains a technical compendium, we are bound to have technically perfect (however boring) "emissions." (Look at our terminology.) Perhaps we should have all our boring Extra Class licensees shut down their legal limit stations and get out a CB walkie-talkie until they become more interesting people and talk about what is important to them. Otherwise, they may fall into the technology and never come back out!

You are inspiring! Thanks.

Rege D. Dvorsky WA3LKT, Grasonville MD Wayne, I would like to comment on the excellent "lightning/ grounding" articles you have had in *73* magazine over the last few months. I thought the articles were excellent and I know they have proved to be the same for many hams. I even had an old friend from Pittsburgh send me a copy (he didn't know I've subscribed).

I think every ham has gone through problems with grounding, RF in the shack, etc. As a matter of fact, I have just put in my own new grounding system, and it actually worked (potluck). Personally, I do not have money for luxuries such as VHF rigs for satellite operation, etc. I have enough problems keeping up my HF and 6 meter station. (I would love to get into satellite operating ... and I do track and listen to *AO-21* and *Mir*. I have also tried the satellite on 10/15 meters and have had no luck with my dipole antenna.) Anyhow, I think it would be great to have more articles that relate to the nagging problems all hams have had, such as TVI, grounding, operating tips, DX QSL routes, and hidden apartment-type antennas.

I would also like to see an article once in a while about shortwave listening, such as the "numbers stations" you briefly mentioned in the March issue. I listen to airline communications all the time and haven't a clue what they are talking about. Also, I live on the bay here and would love to know where the HF maritime frequencies are. I think listing some of these interesting stations would really spark some interest in your readers.

James Alderman KF5WT, Carrollton TX Wayne, I read your editorials regularly and often agree with you, so I thought you might like to hear about an interesting thing that happened to me not long ago.

Recently, while traveling out of the Dallas area, I was talking with a gentleman on one of the metro-area's most popular repeaters. This gentleman was a retired veteran. I happened to mentioned that I believe flag burning to be wrong, and that it is also wrong to have a dope-smoking draft dodger commanding our armed forces, something he agreed with.

Suddenly another station broke in to say that we shouldn't be mentioning a political comment on the air because somebody might be listening and not agree with it. "It might be divisive," the station said. Well, about this time I began to drop out of range, but I could hear hams from everywhere coming on board not only to agree with my comment but, more importantly, to agree with my *right to say it*.

This guy said that good amateur courtesy mandates that "sex, religion and politics" not be mentioned on 2 meters. I looked in all my ham books, and it's not there. I looked in part 97, and it's not there either. So the *fact* is that I have the same right to speak as anyone else. The only breach of courtesy would be if I were to express my conviction and refuse to allow anybody else to have their turn on the repeater.

Now, on this repeater I have heard every view, from legalizing drugs to outlawing high school sports. In fact, the club that owns the repeater used to have an issue discussion net on the air; the day I heard it the subject was, "Should we have rebuilt Japan after defeating them in WWII?" And who could forget the lively discussion that ensued the day that "codeless licensing—pro or con" came up.

I remember when your magazine carried this question: "Think about the most interesting talk show that you've ever wanted to call in to, and ask yourself this: Why can't morning drive time on the repeaters in America be just that interesting?"

You're right, Wayne. Most of the conversation on repeaters amounts to a bunch of nothing. I like issue discussions—they challenge me to think and I always end up learning something by listening to varied views. Sad to say, very little stimulating conversation happens on ham radio.

When I told a non-ham friend how I had been chided for my remarks, he said, "I didn't want to tell you this but that's exactly why I have never wanted to get my ham license. All the times I've ridden with you I've never heard anything on that radio worth listening to." When I reminded him that he might need the radio in an emergency, he replied, "I've driven all over Texas—even into far west Texas—and have never driven out of cellular phone range." What could I say, Wayne? He was right.

You know, if intelligent and educated people stay away from amateur radio in droves, if we continue to scarcely utilize our valuable frequencies, rarely home-brewing our own gadgets or coming up with anything innovative, talking about nothing on the air and roasting those who wish to do otherwise, running off more people than we attract, can we be surprised if we lose all our bands to commercial interests? And if that happens, do we have anybody to blame but ourselves?

Atlee Kohl, Irving TX Wayne, your March 1995 editorial on the Internet was "too close for comfort." I've thought more than once about dramatically downsizing my own ham radio activities—in terms of both time and equipment—to allow for "Internet ops" on a variety of specialized subjects that greatly interest me. As you pointed out, ham radio could be there and beyond if wise decisions had been made by our ARRL leadership over the last three decades.

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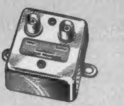

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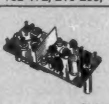

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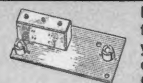

Helical resonator filters may **reduce your intermod & cross-band interference.**

MODEL HRF-(*), *$59 vhf, $99 uhf.*

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- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (atv conv. to chan 3).
- **Kit less case *$49,* kit w/case & BNC jacks *$79,* w&t in case *$99.***

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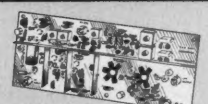
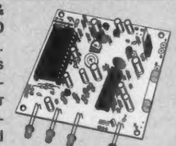


XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 432, 435, and atv. 1W output. **Kit only $89 (vhf), $99 (uhf).** *PA's up to 45W available.*

REPEATER CONTROLLERS

NEW **CWID-2.** Eprom-controlled, miniature, easy to build, low power CMOS, (specify call) .... **only $54 kit, $79 w/t**



COR-6. COR & Real Voice ID on one board. Digital ic records up to 20 seconds of your voice. Can record multiple id messages. Tail and time-out timers, courtesy beep, solid-state relay to key transmitter. ....**kit $99, w&t $149**

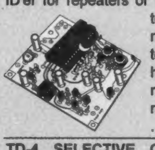
COR-3. COR, timers, court.beep .... **kit $49**

CWID. Diode programmable .... **kit $59**

COR-4. Complete COR and CWID all on one board. CMOS logic for low power consumption. EPROM programmed; (specify call) ....**kit $99, w&t $149**

ACCESSORIES

DVR-1 DIGITAL VOICE RECORDER. Records up to 20 sec. of your voice with built-in mic. or external mic. Terrific as voice ID'er for repeaters or fox hunt xmtr, contest caller, radio notepad, etc. Extensive manual tells how to use multiple messages adapt to many applications. ......**kit $59, w&t $99**



TD-4 SELECTIVE CALLING Module. Versatile dtmf controller with 1 latching output. **Mutes speaker until someone calls** by sending your 4-digit tt code. Or use it with a **long tt zero** digit to alert anyone in club. Also may be used to **control autopatch or other single device.** ....**kit $49, w&t $79**

TD-3 CTCSS (SUBAUDIBLE TONE) DECODER/ ENCODER .... **kit $29, w/t $59**

AUTOPATCHES

AP-3 REPEATER AUTOPATCH. Reverse patch and phone line remote control. ....**kit $89, wired & tested $139**

AP-2 SIMPLEX AUTOPATCH Timing Board. Use with above for simplex operation using a transceiver. .... **kit $39**

TD-2 DTMF DECODER/CONTROLLER. 16 digits, jumper-programmable, toll-call restrictor. Can turn 5 functions on/off. ....**kit $79, wired & tested $129**

DATA MODEMS

MO-202 FSK DATA MODULATOR & DE-202 DEMODULATOR. Run up to 1200 baud digital signals through any fm transmitter & receiver.....**kits $49, w&t $79**

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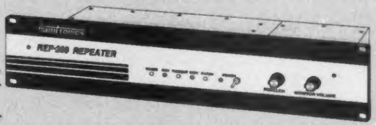

- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- **FCC type accepted** for commercial service in150 & 450 bands. *(Request catalog for details.)*

REP-200T Voice Message Repeater. As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air.** Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!.........................adds only $100!**

REP-200C Economy Repeater. Uses COR-6 Controller (no DTMF control or autopatch). Features **real-voice ID.** ....**Kit only $795, w&t $1195**

REP-200N Repeater. Want to use your own controller? No problem! We'll make you a repeater with rf modules only. .... **Kit only $695, w&t $995**

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FM EXCITERS: 2W continuous duty.
FCC type accepted for com'l bands.
- **TA51:** 50-54, 143-174, or 213-233MHz.
- **TA451:** 420-475 MHz . *New low price!*

Either model: ....**kit $99, w/t $169.**
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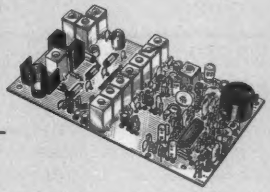
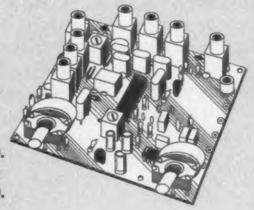
New low price! .... **w/t $199.**



VHF & UHF AMPLIFIERS.
For fm, ssb, atv. Output levels from 10W to 100W. Models **starting at $99.**

FM RECEIVERS:



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NEW **R150 MONITOR RCVR** for 143-164 or 216-225 MHz. 4-channels. Great for monitoring repeaters, amateur calling frequencies, packet radio, commercial two-way radio, police/fire frequencies, or weather forecasts. **Good starter kit,** easy to assemble and align........**kit only $99, w/t $189.**
- **R120 AIRCRAFT RCVR** for 110-136 MHz .... **kit only $99, w/t $219.**

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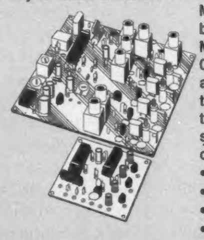

- **R138 Receiver** .... **$129 kit, $189 w/t**
- **AS138 Scan Adapter** .... **$39 kit, $69 w/t**
- **Channel Crystals** .... **$12 ea**
- **ARRL Weather Satellite Handbook** **$20**

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QRX . . .

Number 3 on your Feedback card

Free SSTV Handbook on the Internet

During the past couple of years, SSTV activity has been growing by leaps and bounds. It was always fun, but now it is no longer complicated and expensive. Unfortunately, it is difficult to find much accurate modern information.

John Langner WB2OSZ has written a short handbook to help combat this lack. It contains sections on how it all began in 1957; how to get started for only a couple of dollars or less; questions and answers; typical color images; commercial products; home-brew products; bibliography, glossary, and much more.

All this is available for free in electronic form on the World Wide Web. The Universal Resource Locator (URL) is http://www.ultranet.com./~sstv. The author can be reached at johnl@world.std.com. *TNX John Langner WB2OSZ.*

SAFEX On Upcoming *Mir* Mission

A meeting was held in Moscow March 24 to 29 on matters relating to the SAFEX Project, with DL3LUM and DL2MDE participating. The discussions centered around the "EUROMIR" Mission scheduled for August 1995. The German Thomas Reiter will spend 135 days on board *Mir*. He is now preparing in Russia for his ham radio license exam and is planning to be active on FM voice and packet during his flight. Schedules will be set up with schools. Operation will be on 70cm and 2 meters. The 2m antenna on *Mir* will soon be replaced with a dual-band antenna. SAFEX will provide equipment for the two bands, including 9600 baud packet which will be used on 70cm. The German/Russian SAFEX Project lists the frequencies to be used as: 437.975 packet and 437.925 FM voice for the downlinks and 435.775 for packet and 435.725 for voice for the uplinks. Thus both offsets will be -2.2 MHz.

The call used on 70cm only will be RR0DL.

(The preceding information, originated by DL2MDE, was received by Ray Soifer W2RS from GB7HSM and was translated from the German by Gerd Schrick WB8IFM. The AMSAT News Service will carry more information on SAFEX as it becomes available.) *TNX AMSAT News Service (ANS), DL7MDE, W2RS, WB8IFM.*

New Ham Band

Ham radio has a new band. The FCC has released a Report and Order allocating the 219 to 220 MHz band on a secondary basis to the Amateur Service for point-to-point fixed digital message forwarding systems.

When the new rules take effect (date to be announced), Technician and higher class amateur licensees will be permitted to use digital emissions of up to 100 kHz bandwidth and up to 50 watts PEP output.

To protect the band's primary occupant, Automated Maritime Telecommunications Systems (AMTS), the Amateur Radio Relay League has been designated as the national contact point for all amateur operations in the 219–220 MHz band. Amateur stations must notify the ARRL at least 30 days prior to initiation of operations in the band. Within certain distances from AMTS coast stations, amateurs must obtain written approval of the AMTS licensee prior to operating. The ARRL will assist amateurs in fulfilling these requirements.

Amateurs operating in this band must not interfere with, nor are they protected from interference by, primary service operations in and adjacent to the band. *TNX ARRL.*

Best of 75 Net

No, you are not listening to another case of malicious interference on some Los Angeles area 2 meter repeater. Rather, this is a weekly on-air competition. It's found every Sunday night on the Best of 75 Meters Net, a place where representatives of all other frequencies can compete against one another to see which one has the strongest signal on the band. Literally a ham radio horse race!

But there is also a serious side to The Best of 75 Meters Net. Each week, net control station Don Simpson KO4TA brings on a well-known guest speaker over his autopatch. One of the first was W5YI VEC Administrator Fred Maia who fielded questions on a wide variety of topics, including the vanity callsign program.

The Best of 75 Meters Net meets every Sunday for at least three hours starting at 7 p.m. Eastern time. Look for it on 3.975 MHz, sit back and enjoy a grand old ham radio fun time! *TNX Amateur Radio Newsline, Feb. 27, 1994.*

SAREX Frequency Changes

Space Shuttle flight STS-71, to be launched in June, is the first to feature a docking between the Shuttle and the Russian *Mir* space station. Special Shuttle Amateur Radio EXperiment (SAREX) voice frequencies will be used.

The special frequencies are: Downlink: 145.84 MHz worldwide; and Uplinks: 144.45 and 144.47 MHz worldwide.

SAREX and *Mir* Amateur Radio stations normally share the same downlink frequency, which would cause interference on the STS-71 mission. Because of this and lessons learned from using particular frequencies during previous SAREX missions, the SAREX Working Group has made these changes for STS-71. The new frequencies were chosen after much deliberation to minimize interference between SAREX, *Mir*, and terrestrial stations.

Most SAREX operations are split frequency, with a downlink (astronauts transmitting to Earth stations) and an uplink (Earth stations transmitting to astronauts). Listen to the downlink and transmit only when the shuttle is in range and astronauts are on the air.

Mir operations are simplex and remain on 145.55 MHz.

Before transmitting, listen to the SAREX uplink to avoid interfering with others, and listen for the astronauts' instructions about frequencies they're using. They won't favor a specific uplink, and your ability to work them will be "the luck of the draw."

If these special SAREX frequencies prove acceptable, they will be used for future docking missions. Note, however, that there is a strong chance that STS-70 will fly before STS-71; if so, STS-70 will use the regular SAREX frequencies. *TNX ARRL Space Bulletin 005 ARLS005, April 5, 1995.*

FAR Scholarships

The Washington, DC, based Foundation for Amateur Radio is once again coordinating the distribution of 56 scholarships for the 1995–1996 academic year. Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school. Applicants must be accepted for enrollment in an accredited college, university, or technical school. The scholarships range in value from $500 to $2,000 each.

For more information please write to the Foundation for Amateur Radio, 6903 Rhode Island Ave., College Park, MD 20740.*TNX Ham Arundel News, April 1995.*

Petition threatens W1AW

A petition for rule making before the FCC would eliminate all one-way transmissions such as code practice and information bulletins on the amateur bands below 30 MHz, including those from W1AW.

The petition, filed by Frederick O. Maia W5YI, publisher of the *W5YI Report* newsletter, seeks to eliminate the rules permitting one-way information bulletins and Morse code practice in the amateur bands below 30 MHz. The effect would be to silence W1AW bulletin and code practice transmissions, among others.

Maia calls the FCC rule permitting certain one-way transmissions on the amateur bands "a very permissive category and taken in its broadest context, permits just about anything to be transmitted that is even remotely associated with the Amateur Service."

He says that code practice is now available on computer software, and information bulletins about amateur radio can be had on various computer on-line services.

Comments on the petition may be sent in the form of a letter to the Secretary, FCC, Washington, DC 20554. The file number, RM-8626, should be shown prominently at the top. An original and five copies is preferred, but single-copy comments will be accepted. *TNX ARRL.*

AEA is more than just great TNCs.

ST-1

ST-1 SATELLITE TRACKER

SATELLITE TRACKING

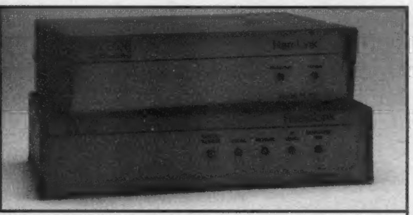
- The ST-1 offers users hardware and software for automatic satellite tracking.
- Automatically controls Yaesu 5400/5600 Azimuth-Elevation rotors and can also be used with other rotors.
- Automatically tunes many transceivers including the FT-736, TS-790, IC-970, and the IC-475/275.
- Software included with the ST-1 is a completely resident program (TSR), so your computer isn't tied up when tracking.
- Software such as InstantTrack, QuickTrack, RealTrack, PG_AEA, PB and PG are compatible with the ST-1.
- Allows unattended operation on Packet satellites (PACSATS).

KK-1

KEYBOARD KEYER

- The KK-1 turns any PC-compatible keyboard into an easy to use Morse machine that shares the keyboard with your computer (cable provided).
- Computer is not necessary, the KK-1 works with the computer's keyboard.
- Loaded with features such as twelve nestable single keystroke message buffers (over 7900 characters total), short-term memory, message repeat, and extensive code practice (random character groups or words).
- This is the only keyer that allows you to send on the air with Farnsworth spacing.
- Adjust character formation speed and average sending speed together or independently, to make your transmissions easier to copy.

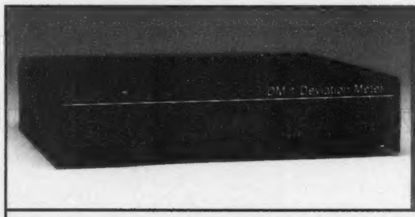
HamLink RadioLink



REMOTE CONTROL

- Both HamLink and RadioLink control your Icom, Kenwood, or Yaesu radio while you are somewhere else.
- HamLink controls your ham station using a cell phone, air phone, or any touch-tone telephone!
- RadioLink controls your ham station from a VHF/UHF radio such as your handheld or mobile radio.
- Both units allow you to change bands and frequency, tune up or down, switch modes (AM/SSB/FM/CW), scan, run split VFO, or virtually any other radio feature from anywhere. (Radio must be computer controllable).

DM-1



MEASURE DEVIATION

- The DM-1 is a deviation meter for FM transmitters operating in the 144, 220, or 440 MHz amateur bands.
- Crystal controlled—no tuning required.
- Dual deviation ranges allow accurate measurement of voice, data, DTMF, and subaudible deviation.
- Accurate deviation adjustment insures faster throughput on packet.
- Automatic disable with low battery voltage ensures accuracy.
- Compact and battery powered for convenient use anywhere.
- Outputs for external digital or analog meters, and an audio output for monitoring through an external amplifier.

Call (800) 432-8873 for a complete catalog or information on a specific product. Contact your favorite amateur radio equipment dealer for best pricing.

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2006 196th Street Southwest
P. O. Box C2160
Lynnwood, WA 98036
(206) 774-5554**

The N4UAU Super CW Station

by Sam Ulbing N4UAU

Look, over in that ham shack! "Why, it's a clock!" "No, it's a keyer!" "No, it's a CW tutor!"

"No, it's the N4UAU Super CW Station!"

If you are a new ham or want to upgrade your ticket, this project will help you master CW. If you are an experienced ham, you will learn to send better and improve your ability to copy in your head. And you will find the receiver function to be a *fun* way to look around the bands while improving your ability to copy code. Whether you are new or experienced, the built-in alarm clock will keep you from forgetting your next sked.

My Keyer Does It All

It is Monday morning about 6 a.m. and I'm sitting in my shack drinking coffee and trying to get my brain in gear for a CW sked I've got at 06:30. Suddenly I hear "DIT DAH DAH, DIT DAH DIT DIT, DAH DAH DAH." It's my CW station telling me it's time to turn on the radio and copy the weather from "WLO." The high-seas forecast is sent by WLO in CW at about 30 wpm and I'm copying it perfectly while glancing through the headlines in the day's paper. You probably think I am a real CW whiz to be able to do that while still half asleep, but I am not. I can only copy about 25 wpm on a good day with all my concentration. And I'm not using my computer either. I am using my keyer to copy and display the code! That's right, my *keyer*.

Actually, I call it the "N4UAU Super CW Station" because it is much more than a keyer or a clock. It also copies and displays CW from your receiver, sends random code (characters, words or callsigns) to practice, and displays it. And when you are ready to send CW, it becomes an iambic keyer, with three memories, that will display what you are sending. It is easy to build, fits in a small box 4" by 6", and costs only about $100 to build.

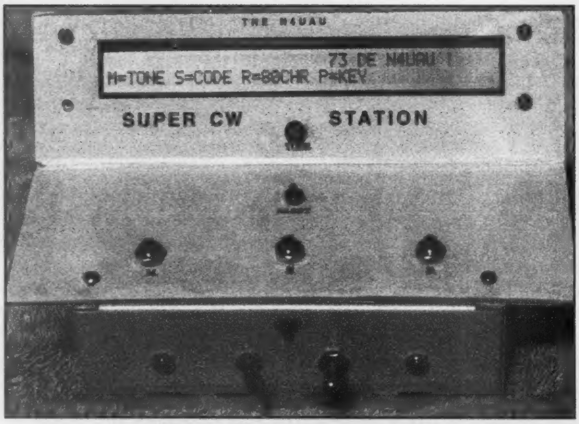


Photo A. The keyer's main menu.

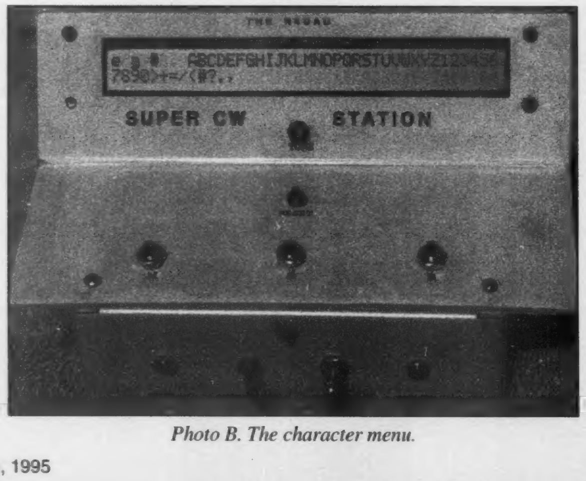


Photo B. The character menu.

Project Features and Operation

The CW STATION does many different things. It:

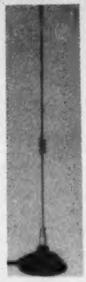
- Copies and displays CW characters from your receiver.
- Calculates and displays the speed of the CW.
- Has an 80-character display mode that stores and displays the last 80 characters of code so you can review your copy and sending accuracy.
- Has a built-in random code generator. You set the character speed, space speed, group size and sidetone frequency. It will send random code in any of three different modes. The first mode sends characters. It lets you select only those exact characters you want to practice. The second mode sends 300 different common CW words. The third mode sends random callsigns. This feature will help you get ready for that CW test which always has at least two callsigns you will need to copy.
- Works as an iambic keyer (2 to 40 wpm).
- Has three message memories. You see the words you are storing in memory and can backspace to correct any errors.
- Displays all the CW characters on a 40-character by two-line LCD.
- Sets and displays all speeds digitally so you know the exact speed you are copying or sending.
- Has a built-in clock and calendar with an alarm.
- Has a built-in sidetone oscillator with an adjustable frequency (600 to 900 Hz).
- Has an on-board audio amplifier that can drive a small speaker.
- Uses a tuning LED to "zero beat" the other station.
- Allows easy external powering with the on-board voltage regulator.
- Can be used with an external key.
- Has battery backup to preserve all memory if a power failure occurs.

The CW station uses only a few parts and is easily built because all the major parts are actually entire subcircuits in themselves. The heart of the project is the 87C52 microprocessor. It is a small process control computer with 8 kbytes of code that control the rest of the circuit. The 40-character by two-line LCD display has several processing circuits built into it that handle all the details of displaying the data. The LM567 decoder has circuitry built in to determine when a received signal is at the proper frequency and then demodulate it. The DS1202 is a time-keeping chip that has day of the week and leap year features.

All you need to do is solder

MFJ *Dual Band* Mobile Antenna

For an incredible $14.95, you get a dual band 2 Meter/440 MHz mobile antenna with strong magnet mount, stainless steel radiator, 15 feet of coax and BNC adapter for your handheld -- It's the fastest selling mobile antenna in ham radio!



MFJ-1724B

$14.95

For an incredibly low $14.95, you get an MFJ dual band 2 Meter /440 MHz mobile antenna!

It's the fastest selling mobile antenna in ham radio!

You get excellent gain for solid, noise-free QSOs. On 440 MHz, it's a high gain 1/2 wave over 1/4 wave radiator. On 2 Meters, it's a *full size* 1/4 wave radiator.

Its tough *stainless steel* radiator is only 19 inches tall -- won't knock off when parking in your garage.

An extra powerful magnet holds it steady -- even at highway speeds.

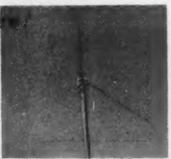
You get 15 feet of coax with a standard PL-259 coax connector for your mobile rig.

You get a BNC adapter so you can also use it with your handheld!

Your MFJ-1724B is protected by MFJ's famous one year *No Matter What*™ unconditional guarantee.

DualBand 144/440 MHz Ground Plane

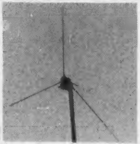
MFJ-1754 **$24.95** *New!*



Dual band ground plane antenna for 2 Meters and 440 MHz gives you extra long range on 440 MHz with a high gain halfwave over quarter wave radiator. On 2 Meters you get solid quarter wave performance. Mounts on 1 to 1 1/2 inch mast with single U-bolt. Easy-to-tune.

1/4 Wave Ground Plane

MFJ-1740 **$12.95**



The MFJ-1740 brings up 2 Meter repeaters as well as any 1/4 wave ground plane made!

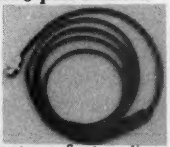
You get easy tuning, low loss ceramic antenna insulator and strong lightweight aluminum construction.

Single U-bolt mounting for 1 to 1 1/2 inch mast. Cutting chart included for 220/440 MHz. Made in USA.

MFJ Pocket Roll-Up™

2 Meter halfwave J-pole antenna

MFJ-1730 **$14.95**



Roll up this *halfwave* 2M J-pole antenna and stick it in your pocket! It's the perfect *gain* antenna for traveling.

Get home station performance on the go. Just hang your *MFJ Pocket Roll-Up*™ in the clear and plug the BNC connector into your handheld.

It's omni-directional and has significant gain over a 1/4 wave. It does not need a cumbersome ground plane so it's convenient for indoors and works great with handhelds. Made in USA

Dual Band *flexible* Ducks

144/440 MHz flexible ducks for HTs

A. *High Gain FlexiDuck*™, **MFJ-1717, $19.95.** Enjoy dependable QSOs when other rubber ducks give you noise. High gain 1/2 wave on 440 MHz, full size 1/4 wave on 2M. Won't jab you -- bends, twists, flexes with you. 15 3/4 inches.

A. B.

B. *FlexiDuck*™, **MFJ-1716, $16.95.** Similar to MFJ-1717. Full 1/4 wave on 440 MHz, efficient loaded 1/4 wave on 2 Meters. 8 3/4 inches.

Shorty Duck™ for HTs

Add this *short*, 4 1/4 inch *ShortyDuck*™ to your 2M handheld for a Q-5 signal! Impedance matched for maximum gain. High-Q helical wound radiator.

MFJ-1718 **$12.95**

5/8 Wave 2 Meter Mobile Antenna

MFJ-1728/B **$24.95**

For *maximum range* while mobile, use MFJ's *Maximum Gain*™ 5/8 Wave 2 Meter Mobile Antenna. You'll get the maximum possible gain of any single element mobile antenna!

Competitive 5/8 wave mobile antennas can't work any better -- no matter how much more they cost.

You get low SWR so your rig can safely deliver maximum power into your antenna. It's rated at 300 watts PEP so you can use any mobile rig plus a mobile amplifier.

You get a heavy-duty magnet mount that holds your antenna tight at highway speeds and a black magnet base that'll look good for years.

You get a stainless steel radiator that'll endure years of harsh mobile use and 12 feet of coax cable.

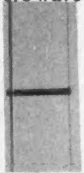
You get MFJ's one year *No Matter What*™ unconditional guarantee.

Order MFJ-1728 with standard PL-259 coax connector or MFJ-1728B that also includes a BNC adapter for your handheld.

Stacked 5/8 Wave for 2 Meters

gives twice the omni-directional gain of a single 5/8 wave

MFJ-1764 **$34.95**



MFJ's stacked 5/8 wave radiators give you *more than twice* the *omni-directional* gain of a single 5/8 wave radiator!

Wide 10 MHz 2:1 SWR bandwidth . . . excellent ferrite choke balun feedline decoupling . . . shunt choke for bleeding off unwanted static . . . strong lightweight aluminum.

Fully assembled -- simply attach radiators -- no tuning required. Mounts vertically for FM/Packet or horizontally for SSB. Installs with single U-bolt on 1 to 1 1/2 inch mast or tower leg. 1 1/2 lbs., two 47 inch radiators, 23 inch boom. Made in USA.

Also works as excellent *6 Meter* full halfwave centerfed antenna.

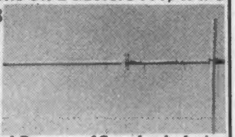
MFJ-1766, $89.95, gives you *four times* the gain of single 5/8 wave. Includes 2 MFJ-1764, phasing cables. Doubles gain on 6 Meters.

MFJ-1765, $29.95, phasing cables for 2 MFJ-1764s, other 2M ant.

MFJ dual band 144/440 MHz Yagi

5 elements on 440 MHz . . . 4 elements on 2 Meters . . . $49.95

MFJ-1768 **$49.95** *New!*



Get two Yagis for the price of one . . . enjoy two Yagis in the space of one with single coax feed!

MFJ's *exclusive* dual band balanced feed with *FerriteChoke*™ decoupling prevents pattern skewing and gives you low SWR.

The MFJ-1768 is based on the *National Bureau of Standards* design that's optimized for maximum forward gain with high front-to-back ratio and a clean symmetrical pattern.

Mounts vertically for FM/Packet or horizontally for SSB with single included U-bolt on 1 to 1 1/2 inch mast or tower leg.

High strength 6061-T6 aluminum 5 foot, 1 1/8 inch diameter boom. 2 pounds. Elements are electrically isolated from boom. Made in USA.

Portable 3 element Yagi for 2 M

MFJ-1763 **$39.95**

You can set up or take down MFJ's *portable* 3 elements 2 Meter Yagi in seconds! Elements simply screw into the boom.

You can take it with you wherever you go and have the "oomph" and directivity of a beam.

It's easy to store and sturdy enough to use as your home station antenna.

Mounts vertically for FM/packet or horizontally for SSB. *Center* or *end* mounts with single U-bolt. Great for packet/PacketCluster™.

It's compact 2 3/4 foot boom gives you a calculated gain within 1 dB of a four element Yagi with a boom nearly twice as long.

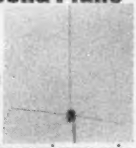
Extra thick elements maintain high gain and directivity over entire 2 Meter band. MFJ's *FerriteChoke*™ decouples feedline.

Elements and boom are made from strong lightweight aluminum and protected by MFJ's *Permanent Molecular Bonding Technology*™.

Weighs just 2 pounds. Boom is 30 1/2 inches. Made in USA.

5/8 Wave Ground Plane

MFJ-1750 **$19.95**



For a low, low $19.95, you get a *high performance* 2 Meter 5/8 wave ground plane home station antenna -- you'll get the maximum gain of any single element antenna.

More expensive 5/8 wave ground planes can't work any better -- no matter how much they cost.

You get . . . shunt fed matching that bleeds off unwanted static and gives you low SWR . . . strong lightweight aluminum construction . . . low loss ceramic antenna insulator . . . MFJ's *RapidTune*™ radiator . . . MFJ's one year *No Matter What*™ guarantee. It mounts on 1 to 1 1/2 inch mast with single U-bolt and is Made in USA.

MFJ-1752, $19.95, for 220 MHz .

HT Range Extenders

Telescoping antennas for handhelds

A. *Long Ranger*™ 2 Meter Halfwave, **MFJ-1714**, $16.95. For really long range this MFJ endfed halfwave is hard to beat. It outperforms a 5/8 wave on a handheld because the 5/8 wave needs a ground plane. The MFJ halfwave doesn't. It's shorter, lighter, has more gain and places less stress on your antenna connector than a 5/8 wave antenna. When collapsed, it performs like a rubber duck. 40" extended, 10 1/2" collapsed.

A. B. C.

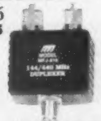
B. *Dual Bander*™ for 2 Meters and 440 MHz, **MFJ-1712**, $14.95. Got a new dual band handheld or separate units? One antenna fits all. It's a 1/4 wave for 2 Meters and a 5/8 wave with gain for 440 MHz. 7 1/4" collapsed, 19" extended.

C. *Pocket Linear*™ 3/8 Wave, 2 Meters, **MFJ-1710,** $9.95. Carry this pen size antenna in your pocket like a ballpoint pen. When you're using your rubber duck, on the fringe and noisy, put on the *Pocket Linear*™, extend it to 24 1/2" and carry on your QSO. Has pocket clip. 5 1/4" collapsed.

144/440 MHz Duplexer

Lets you use dual band 144/440 MHz antenna with separate transceivers *or* separate 144/440 MHz antennas with dual band transceiver.

MFJ-916 **$29.95**



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CIRCLE 86 ON READER SERVICE CARD

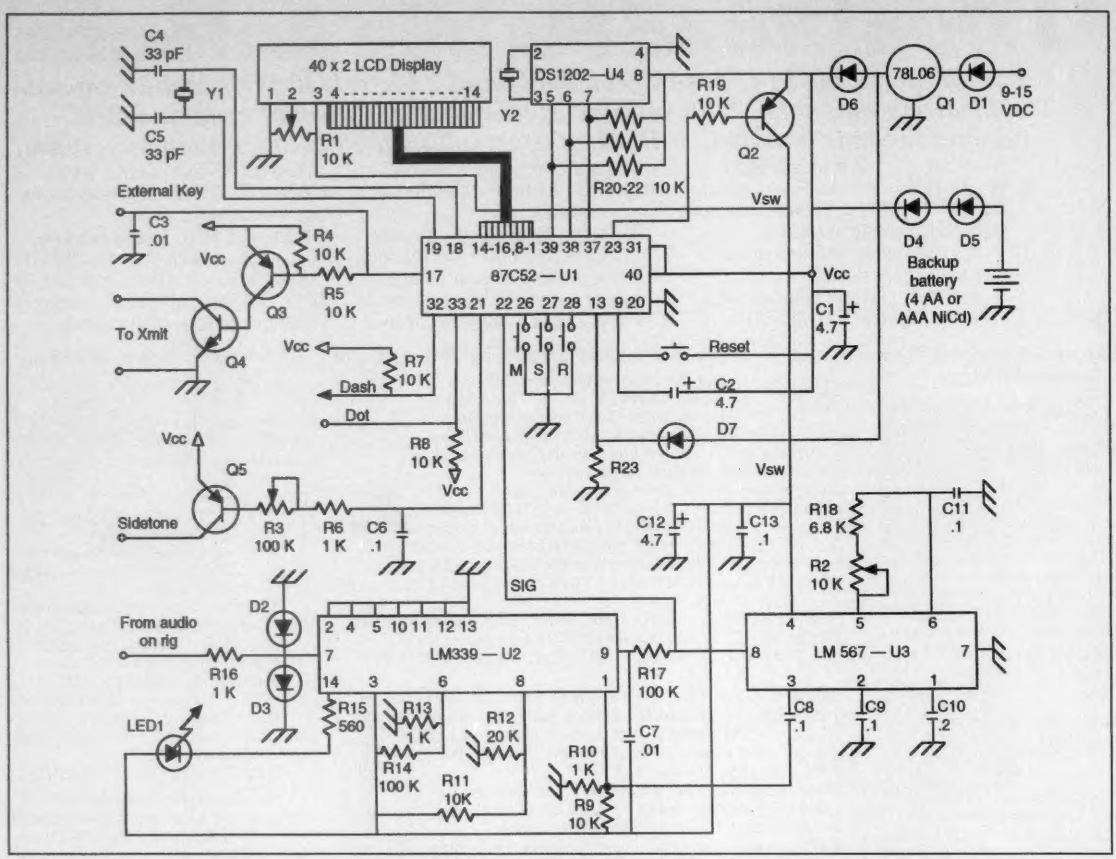

C4
33 pF
Y1
C5
33 pF
40 x 2 LCD Display
1 2 3 4 14
R1
10 K
2 4
DS1202—U4 8
3 5 6 7
Y2
R19
10 K
Q2
R20-22 10 K
D6
78L06
Q1
D1
9-15 VDC
External Key
C3
.01
R4
10 K
Vcc
R5
10 K
Q3
To Xmit
Q4
Vcc
R7
10 K
Dash
Dot
19 18 14-16,8-1 39 38 37 23 31
17 87C52 — U1 40
32 33 21 22 26 27 28 13 9 20
M S R
Reset
C2
4.7
Vsw
D4 D5
Backup battery (4 AA or AAA NiCd)
Vcc
C1
4.7
D7
R23
R8
10 K
Vcc
Vcc
Q5
Sidetone
R3
100 K
R6
1 K
C6
.1
C12
4.7
C13
.1
Vsw
R18
6.8 K
C11
.1
R2
10 K
SIG
D2
From audio on rig
R16
1 K
D3
LED1
2 4 5 10 11 12 13
7 LM339 — U2 9
14 3 6 8 1
R15
560
R13
1 K
R14
100 K
R12
20 K
R11
10K
R17
100 K
C7
.01
R10
1 K
R9
10 K
4 5 6
8 LM 567 — U3 7
3 2 1
C8
.1
C9
.1
C10
.2

Figure 1. Schematic for the Super CW Station.

these parts together, set the display brightness to your liking, set the decoder to the frequency for your rig, and enjoy it!

Circuit Description

There are basically two sections to the CW station. The *microprocessor circuit* does all the processing in an 87C52. In it is an 8 kbyte program which the 11.0592 MHz crystal runs at a rate of about half a million instructions per second. When an incoming signal is received, the microprocessor measures the time of the element and determines whether it is a dot or a dash. This information is saved until an inter-character space is received. The microprocessor then determines what character was received by looking it up in a table, then that character is sent to the top line of the LCD display via 11 lines. The second line shows the speed of the code and the time of day. If you want to use the built-in iambic keyer function, the microprocessor will sample the paddle input lines and send the appropriate dots, dashes and corresponding spaces for that speed. It will also determine what character is being sent and display it on the LCD. The microprocessor sends the dots and dashes to pin 17, where they go to two transistors (Q3 and Q4) which can drive your transmitter.

Another signal is output at pin 21. This is a sidetone signal which goes to the audio amp (Q5). With the sidetone you can listen to your sending if you just want to practice and not actually transmit. The 10k pot (R1) is used to adjust the brightness of the LCD.

Four push-buttons are connected to the microprocessor. These are used to set speeds and control the various functions of the microprocessor. To prevent loss of clock or memory data, the circuit allows battery backup. When a power failure occurs, a signal is sent to the microprocessor at pin 13, causing the microprocessor to shut down all the circuits and put itself into a sleep mode. When power is restored, the keyer will wake up with all the data saved.

The *demodulator circuit* is the other part of the circuit. It decodes signals from your radio and sends them to the microprocessor. When a CW tone is heard on the speaker of your receiver, it is a series of dots and dashes that are modulated at around 750 hertz. In order for a computer to decode the tone it is necessary to make the signal either a high or low voltage level (5 volts or 0 volts). As with human CW operators, it is also necessary to filter out as much extraneous noise as possible so that a clean signal is available for copying. The demodulator helps do this with two IC chips.

The audio signal is brought into an LM339 quad comparator (U2) at pin 7. When the signal voltage is less than the voltage at pin 6 (set by R13 and R14), the output at pin 1 goes to ground. When the signal voltage is greater than the pin 6 voltage, 500 millivolts are applied to U3 because of the voltage divider formed by resistors R9 and R10.

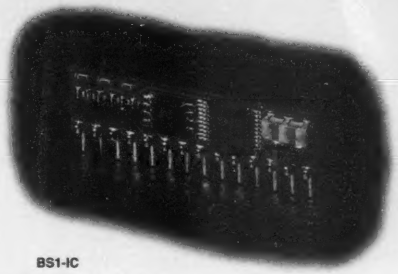
U2 serves two purposes. First, it rejects noise levels that are not as strong as the desired signal. Second, it keeps the voltage to U3 independent of the signal strength. It is either 0 when no signal is recognized, or 500 millivolts if a signal is present. This is important for U3 to work properly. U3 is an LM567 designed to decode DTMF type signals and is basically a phase-locked loop. The lock frequency is set by R18, the 10k pot (R2) and C11.

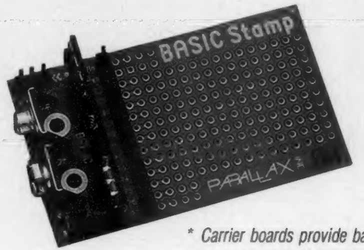
C9 and C10 set the bandwidth. The maximum possible bandwidth of 14% of the center frequency (105 Hz at 750 Hz) is a pretty narrow filter, but it is ideal for our purpose. When the 500 millivolt signal from U2 is in the passband of the LM567, the output at pin 8 goes to 0 volts; otherwise, it is held at 5 volts by the 8752.

Tuning into a bandwidth of 100 Hz can be tricky. To make it easier, a second comparator on the LM339 is used to indicate when the sending station is in tune. The LED will flash the CW when it is tuned in; otherwise it will be off. Between looking at the LED and listening to the frequency of the code, you can tune in a station quickly and accurately.

BASIC STAMP MODULES®

Stamp-sized modules run BASIC

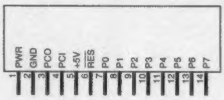




BASIC Stamp
PARALLAX

BASIC Stamp I Module (BS1-IC)
8 general-purpose I/O lines
256-byte program space (100 instructions)
4-MHz clock (2400 baud serial, etc.)
$34, $54 with carrier board*

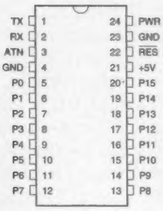
BS1-IC



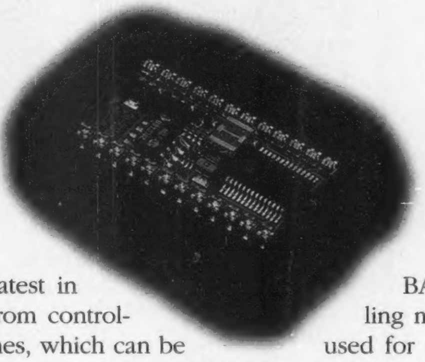
PWR
GND
PCO
PCI
+5V
RES
P0
P1
P2
P3
P4
P5
P6
P7
1
2
3
4
5
6
7
8
9
10
11
12
13
14

** Carrier boards provide battery clips, prototyping area, programming connector, and reset button (BS1-IC carrier shown).*

BS2-IC



TX 1
RX 2
ATN 3
GND 4
P0 5
P1 6
P2 7
P3 8
P4 9
P5 10
P6 11
P7 12
24 PWR
23 GND
22 RES
21 +5V
20 P15
19 P14
18 P13
17 P12
16 P11
15 P10
14 P9
13 P8



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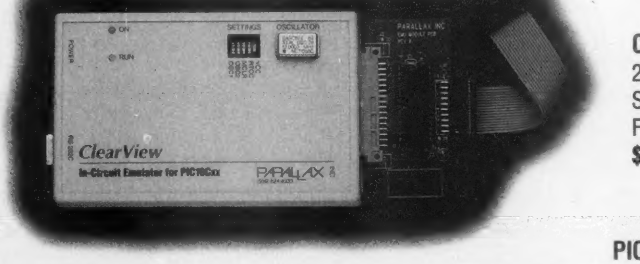

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SETTINGS
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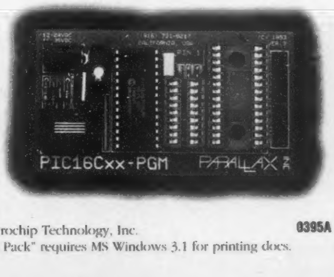

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0395A

Building the Project

With only a few parts and the PC board, this project is easy to build. There are a number of wires running from the PC board to switches and displays on the case. A careful layout will make the project neater. I have used a 4" by 6" aluminum case for my CW station and a Lexan top (see the photos). The aluminum box acts as a ground for all the jacks mounted to it, so I do not need to run a separate ground wire for each jack, thus reducing clutter.

The Lexan top protects the rather soft surface of the LCD display. Also, because it is easily heated and bent, I was able to set the LCD and LED at a better viewing angle. I used Lexan because it does not break, but Plexiglas works well, too, if you are careful. You can also use a plastic box, but you will need to run a ground wire to all the jacks. The current draw is about 30 milliamps (without the speaker) and you can power it from a 9- to 15-volt source. I have found a wall transformer to be a good power supply.

Using the CW Station

When you turn on the CW station, you will see the clock displayed. In this mode you can set the clock or alarm data, or you can enter the main menu by pressing the "M" button. In the main menu, "73 DE N4UAU" is displayed on the top line of the LCD. The second line shows: "M=TONE S=CODE R=80CHR P=KEY." You have the choice of going to one of several sub-menus, depending on what you want to do with your CW station:

1. Touch either the dot or dash paddle to use the CW station as a code translator and iambic keyer.
2. Press the "S" button to enter the random code generator.
3. Press the "R" button if you want to use the 80-character feature.
4. Press the "M" button to set the sidetone frequency.

Receiving and Sending CW

To copy incoming code, tune in a station. The tuning LED will be off until you tune it into the 100 Hz passband. When you see the LED flashing on and off with the Morse code, you are tuned in and you will see the received code scrolling across the top line of the LCD. The bottom line will show the speeds you set and the actual speed of the incoming code. The current time of day is also displayed on this line.

When you are in the receiving mode, you can send code just by touching your paddles or key. The receiver will stop copying the incoming code and will send and display your code. The code you are sending is displayed in capital letters to distinguish it from the received code, which is in small letters.

THE N4UAU
73 DE N4UAU !
M=TONE S=CODE R=80CHR P=KEY
SUPER CW
STATION

Photo C. The keyer connected to a paddle.

Electronic parts:

U1	87C52 preprogrammed micro
U2	LM339
U3	LM567
U4	DS1202
40 x 2 LCD display	
Q4	NPN transistor—2N4400
Q2,Q3,Q5	PNP transistor—2N3906
Y1	11.0592 MHz xtal
Y2	32.768 kHz xtal (6 pF)
Q1	78L06 voltage regulator
D2,D3,D4,D5,D7	1N4148 diode
D1,D6	1N4001 diode
R3	100k pot
R1,R2	10k pot
R14,R17	100k resistor
R4-5,R7-9,R11,R19-23	10k resistor
R18	6.8k resistor
R6,R10,R13,R16	1k resistor
R15	560 ohm resistor
R12	20 ohm resistor
C1,C2,C12	4.7 µF capacitor
C10	0.2 µF capacitor
C6,C8,C9,C11,C13	0.1 µF capacitor
C3,C7	0.01 µF capacitor
C4,C5	33 pF capacitor
For U1	40-pin socket
For U3,U4	8-pin socket
For U2	14-pin socket
PC board	
LED 1	LED—high intensity
M,S,R,RESET	N.O. push-button switches
Hook-up wire	
Parts for box shown:	
4" x 6" aluminum box	
1/8" Lexan, 5" x 8"	
Speaker	
12 VDC wall transformer	
Assorted hardware	

To change your sending speed, press the "S" button and use the dot and dash paddles to increase or decrease the speed (2 wpm to 40 wpm). When you stop sending, the keyer will shift back to the receiving mode.

The microprocessor calculates and displays the actual speed of the code it is processing by averaging the speed of the last 20 characters. It takes into consideration the element speed you set at the start, the number of blank spaces, and the characters being sent. The code display provides feedback on how good your sending is. If you are running characters together, you will see "&" rather than the letters you thought you sent. Increase your spacing a bit between the dots and dashes and you will see the letters.

You can use the keyer with an external key. However, you will need paddles to set speeds, etc. If you do not have paddles, a pair of push-button or microswitches can be used as a paddle to set speed. You can swap between using the internal and an external key any time you are in the receive mode.

When you first enter the keyer mode, the display will ask if you want to store a message. You can store three different messages. If you make a mistake when you are storing the message, just stop and press the "S" button. The cursor on the display will backspace and erase a letter at a time. When you have erased the error, just continue sending the message. You can send the message anytime you are using the keyer functions by pressing "M" and the appropriate memory location ("M," "S" or "R" button). The "R" message is also used by the alarm clock feature (see below).

The Random Code Generator

When you enter this mode you will see the first of three menus, the *speed menu,* which displays "CHAR=XX SPC=YY." You can set two speeds. The character speed sets how fast the elements are sent, and the space speed sets the spaces between characters and groups. This will let you send Farnsworth at any speed you want.

The next menu is the *mode and groups menu.* The mode can be set to "WRDS," "SIGN," or "CHRS." The WRD mode will send 300 common CW words and abbreviations. The SIGN mode sends callsigns. The U.S.-designated callsigns are used and suffix addenda are also sometimes added; i.e. /AG, /AA, /AE, /M, /2, etc. This allows you to get used to the callsigns most commonly used in exams.

In the CHRS mode, random characters are sent. You can set the character group size from 0 to 15. With the group set to 0 the keyer will send characters one at a time. Each time you press the dot paddle, the keyer will send and display the next character and then stop. If you want to hear the same character again, press the dash paddle. You can do this as often as you want until the sound of that character is familiar. To listen to a different character, press the dot paddle.

In the WRDS mode, the group size is used to set the way words are sent. Normally, words are sent to fill the LCD display and the Tutor stops so you can check your copy.

Field Day in a Bucket?

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The emergency communications team that took a Grab-N-Go to San Salvador for the earth quake had never used one before. But they were on the air 15 minutes after unloading the taxi.

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Put the TNT Grab-N-Go to the test like low-power enthusiast Bob Joiner, WB7BIV. Bob took one out into the western Oregon woods for field day. Using its launching system, 68 year-old Bob placed the antenna feedpoint at 75 feet. Then working the ends around the branches, he tied them off to form an inverted V. Fifteen minutes from go, he went on the air.

Over the next 24 hours, Bob operated 80, 75, 40, 20 and 15 meters. He contacted 196 stations across North America from one coast to the other, *using only 950 milliwatts of output power*—less than a pencil-sized flashlight consumes.

That's the bottom line: The TNT Grab-N-Go is not only quick to deploy, it gets the message out when the chips are down.

Readiness has a Payoff

You don't have to wait for disaster to enjoy the benefits of preparedness.

Picture yourself at the end of the day encamped in pine scented solitude while chatting with radio friends across the continent.

Visualize the warmth of the cabin fireplace as the sun sets on the ski slope and the cold winds howl in the chimney. Yet even here, you can communicate with the whole world as you wait for tomorrow.

And think of the fun of talking to the antipodes late into the night after a full meal of fish caught in a clear mountain lake.

All these early benefits of preparedness are more than pure enjoyment. They ensure that you really have what it takes to be of service when lives depend on it.

Besides, imagine the satisfaction of setting up for field day as quickly as most hams can unload the cooler from the trunk of the car. ■

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CIRCLE 57 ON READER SERVICE CARD

If you want to try practicing copying words in your head, you can set the group size to 0 or 1. The code generator will send random words continuously and they will scroll across the screen. You won't be able to write the words and check them, but if you want to learn to copy in your head this will give you good training.

The third menu is the *character menu*, which lets you select which characters you want to practice. It is only displayed if you select the CHRS mode. When it is first displayed, you will see all the possible characters. To select just some of the characters, use your paddles to "erase" the characters you do not want to copy, and leave the ones you do want to practice.

When you are ready to copy random code, the code will be sent and displayed on the LCD screen. When the screen is full, the Tutor will stop and let you compare your copy with what was sent. To send another set of 80 random characters, just press a paddle.

The 80-Character Mode

In this mode you can send or receive code but it will not scroll across the screen. Instead, it will fill up the 80 characters on the screen and stop. This feature is especially useful if you are copying code with pencil and paper, because it lets you concentrate on copying, and after 80 characters you can check your results. This mode is also helpful when you are practicing your sending, because it will let you concentrate on sending, and when the display is full you can check to see how well you sent.

Constant Tuning and Sidetone

This mode will let you send a continuous tone to the transmitter, and a sidetone signal. You can use this mode to tune your antenna or to change the frequency of the sidetone oscillator. The sidetone frequency can be set from 600 Hz to 900 Hz.

The Clock Mode

The clock mode displays the time, date and day of the week. In this mode, it also shows if the alarm is set. When the alarm is activated, the clock will send the message stored in memory "R." It sends it in CW on the sidetone speaker (but not to the transmitter!) and simultaneously displays it on the LCD. This message can be up to 15 characters in length. If you do not have a message in memory, the alarm just beeps.

Obtaining the Parts

Except for the 8752 and PC board, all parts are available from catalog parts suppliers like Digi-Key, Mouser, JDR, etc. The pre-programmed 87C52 and PC board are available from the author (5200 NW 43rd St., Suite 102-177, Gainesville, FL 32606; E-mail n4uau@freenet.ufl.edu) for $40. In addition, the author has a convenience pack of all the electronic parts for $85 and a limited number of box parts (aluminum box, pre-bent Lexan cover, speaker and wall transformer) for $15. Florida residents add sales tax please.

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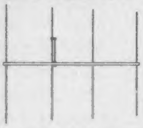

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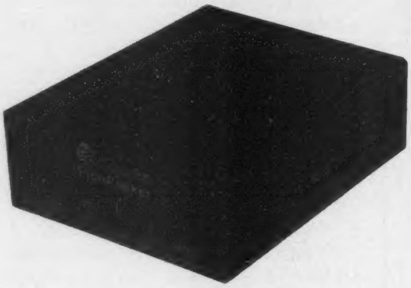

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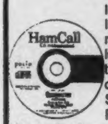

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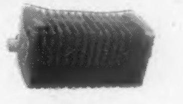

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Number 5 on your Feedback card

Collinear 5/8-Wave Omni Antenna for 2 Meters

Commercial antenna performance at a home-brew price!

by John Conklin WD0O

Ready to try your hand at building an omnidirectional gain antenna? This may be just the project for you! Using ordinary hand tools, you can construct this antenna in one evening from common hardware store materials.

dB or Not dB?

What does all this gain stuff mean . . . really? An electronic amplifier has an absolute limit to the amount of power it can produce, regardless of the input level. Accordingly, amplifiers are often rated in watts—an absolute term. Antennas on the other hand, have no maximum theoretical output power—what you get out of them depends on what you put into them. Therefore, antenna performance is rated in relative, rather than absolute, terms. Enter the decibel (dB). A decibel is one tenth of a bel, named for Alexander Graham Bell (hence the little d and capital B). Originally established to express changes in sound levels, the decibel is a term of relative power. A change of 1 dB in power level is just barely detectable by the human ear.

The correlation between the dB and power ratio is:

dB = 10 log (output power/input power)

A gain of 3 dB corresponds to a doubling of power. Thus, an antenna with a gain of 3 dB will have the same effect on your signal strength as if you had doubled output power. As an added bonus, the gain of an antenna applies to received signals as well.

Where does all this extra power come from? According to the first law of thermodynamics (conservation of energy), you can't get something for nothing. To create gain in any given direction, the power must be taken from some other direction. In the case of a beam, most of the RF is concentrated toward the front of the array and sacrificed at the sides and rear. An omnidirectional antenna, on the other hand, obtains its gain by reducing the amount of RF that is radiated upwards. Look at it this way: An omni antenna has a radiation pattern shaped like a doughnut. In order to increase its gain, the doughnut merely needs to be flattened, thus putting more signal out instead of up.

Gain must be expressed in relation to some standard for it to have any meaning. In antenna work, these values are usually ren-

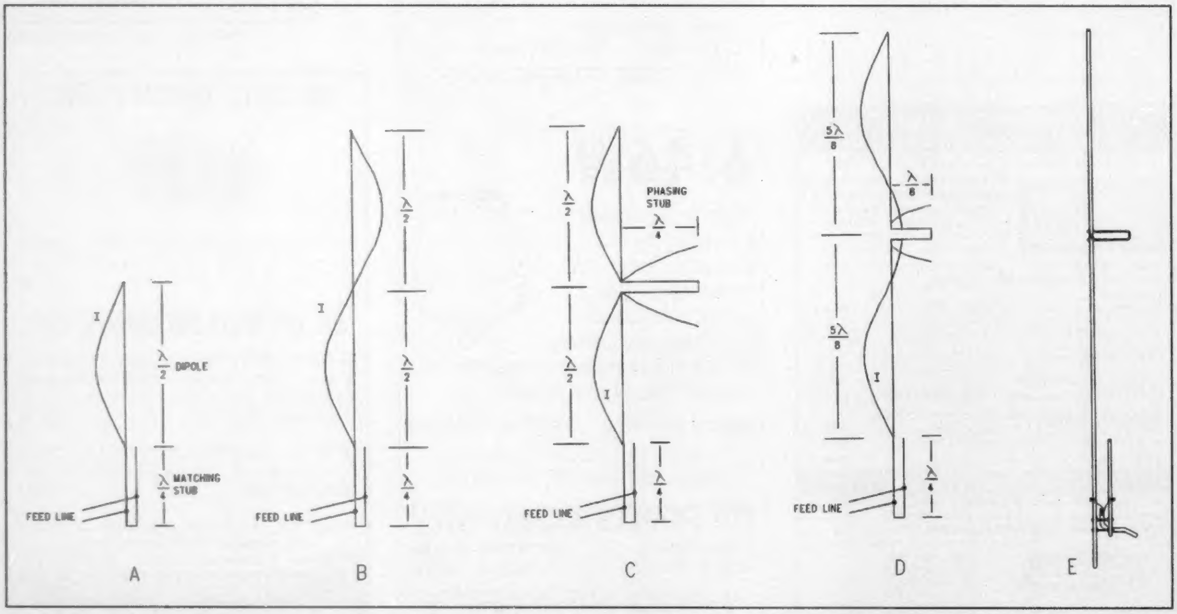

Figure 1. From dipole to deluxe. See this section of the text.

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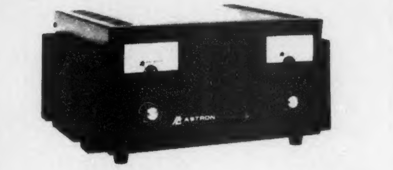

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ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
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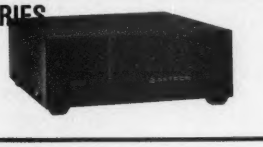
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES



- LOW PROFILE POWER SUPPLY

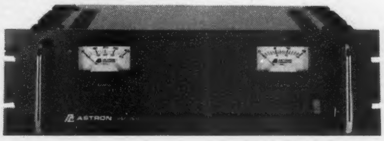
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

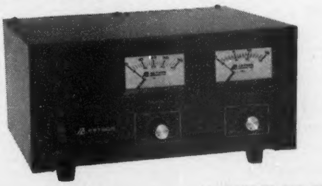
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES



MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	Continuous Duty (Amps) @10VDC	Continuous Duty (Amps) @5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2⅝ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

dered in terms of dBd (gain over a dipole), or less commonly, dBi (gain over isotropic). Since an isotropic radiator is a purely theoretical antenna, all measurements in this article are expressed in dBd. Incidentally, many manufacturers neglect to include any standard reference point in their advertising. There is no way of telling whether the purported gain is over a dipole, a ground plane, a dummy load or isotropic—even the venerable dipole has 2.1 dB gain over isotropic! It's wise to take advertised claims with a grain of salt.

From Dipole to Deluxe

An assortment of aluminium and hardware can double your effective radiated power. Here's how.

As you probably know, a half-wave dipole is customarily fed at the center. This is where the current is highest and the voltage is lowest, thus providing a nice, low impedance point for connecting 52-ohm coax. At the ends of the half-wave antenna just the opposite situation exists—the current is lowest, and the voltage is highest, constituting a very high impedance feed point.

Some sort of matching device must be used in order to overcome the impedance mismatch if an antenna is to be end-fed. The quarter-wave closed stub, a continuously variable impedance matching device, performs this function rather nicely. Think of it as a dipole folded in half. The impedance is very low at the closed end of the matching stub (center of the dipole), and very high at the open end of the stub (ends of the dipole). Connect the antenna to the open end and the feedline near the closed end (Figure 1A). The impedance can now be changed by simply moving the feed point up or down the stub. As an added advantage, the closed end of the matching stub may be grounded, thus placing the entire antenna at DC ground potential and simplifying mounting problems.

Now for some gain. If the length of the antenna is increased to two half-wavelengths, the antenna will exhibit only slight (0.5 dBd) gain. This is because the currents along each element are out of phase and cancel each other out (Figure 1B). However, if each of the two half-wave elements are fed in phase, the gain will be 1.9 dBd because the RF currents reinforce, rather than cancel, each other. In order to achieve this phasing, the signal must travel an extra half wavelength before arriving at the second element. The phasing stub is a half-wavelength conductor folded so that the sides are parallel and closely spaced (Figure 1C). RF currents along the stub are then equal in intensity but opposite in polarity, causing the currents to cancel and preventing the stub itself from radiating.

Antenna gain is further boosted to 3 dBd by increasing the spacing between elements. This is accomplished by lengthening the radiating elements to 5/8 wavelength and shortening the phasing stub by an equal amount (Figure 1D). The added length of antenna is out of phase, and causes some signal cancellation. However, since the current on the added length is small, and the section is short, the radiation is insignificant. Further lengthening of the elements will cause more cancellation, and the gain will actually decrease. The finished antenna is shown in Figure 1E.

Construction

Figure 2 illustrates the dimensions and layout of the antenna. Construction is straightforward and requires only the use of common hand tools. The majority of the antenna is made from 3/4" aluminium tubing, although any diameter from 1/2" to 1" should work fine.

Start by cutting the matching stub (23"), the lower radiating element (78-3/4"), and the upper radiating element (48-3/4") to length. Use a hacksaw to cut a 1-1/2"-long slit into the bottom end of the upper radiating element, and the top end of the lower radiating element. This will allow the tubing to clamp firmly around the insulator.

Next, drill the mounting holes in the matching stub and lower element. Position the top of the matching stub 48-3/4" down from the top of the lower radiating element and tape them together. This will keep them lined up while drilling the mounting holes. Make drilling marks on the matching stub 19" and 22" down from the top of the stub. Clamp the assembly in a vise (being careful not to crush the tubing) and drill through both pieces at the same time. Mount the matching stub to the lower radiating element with 3/16" galvanized washers, nuts and bolts (you'll need bolts that are threaded all the way to the head).

The insulator is a plastic or Fiberglas rod (obtainable at plastics supply houses) or wooden dowel waterproofed with either urethane or spar varnish. The insulator should be at least 9" long to provide good mechanical support between the two radiating elements and should be of a diameter that provides a snug fit inside the tubing. Slide the upper and lower elements over the insulator, leaving 1/2" exposed between sections.

Next, drill a phasing stub mounting hole in each element. The holes must be parallel and spaced 2" apart. The phasing stub is made from a 22" length of 10-24 threaded rod. Bend the center of the rod over a 2"-diameter pipe to produce a smooth bend. Then fasten the phasing stub to the antenna with 10-24 hardware. Stainless steel hose clamps are used to connect the coax to the matching stub, and the end of the coax is sealed with RTV sealant or electrical tape.

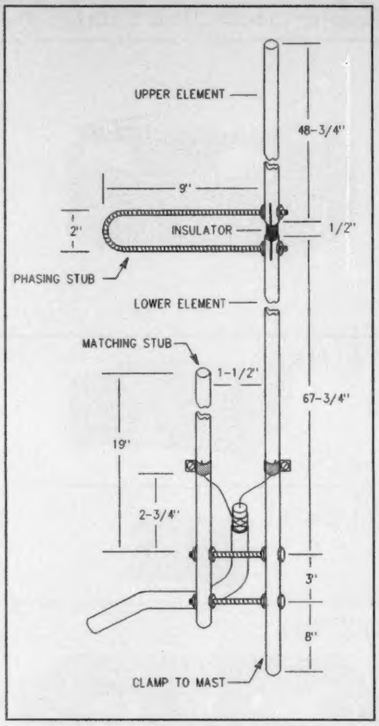


Figure 2. Construction details.

Adjustment

This antenna delivers good performance and has a respectable SWR curve over the entire 2 meter band. Tuning is accomplished by sliding the feed point (where the coax is clamped to the antenna) either up or down to secure the best match.

Bibliography

1988 *ARRL Antenna Book*.
1991 *ARRL Handbook*.
DeMaw, Doug, *W1FB's Antenna Notebook*, 1987.
Honeycutt, Richard A., *Popular Electronics*, August 1992, p. 65.

Parts List

Upper element	3/4" x 48-3/4" aluminum tubing
Lower element	3/4" x 78-3/4" aluminum tubing
Matching stub	3/4" x 23" aluminum tubing
Phasing stub	10-24 x 22" threaded galvanized rod
Insulator	Plastic, Fiberglas or wooden dowel, 9" long, diameter to fit tubing
4	10-24 nuts
4	#10 lock washers
2	3/16" x 3-1/2" bolts
6	3/16" nuts
6	3/16" lock washers
2	1" stainless steel hose clamps

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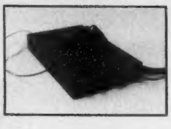

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FX-50 kit (6 Meters)	$149.95	FX-146 kit (2 Meters)	$149.95
FX-223 kit (1 1/4 Meters)	$149.95	FX-440 kit (3/4 Meters)	$169.96
CFX matching case set	$29.95	FXM-1, ICOM/Yaesu style speaker mike	$29.95

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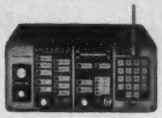

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Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz units. Both have all the features of the high-priced boosters at a fraction of the cost.

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Finally, a handy go anywhere rig that puts the fun back into ham radio. How about the DDS synthesizer that tunes in 10 Hz steps with exceptionally low noise for weak signal reception. Or, how about the built-in lambic CW keyer that has a digital readout of your CW speed. Perky 10 watt RF output (that's only 11/2S units below a 100 watt rig!) can be tuned down for true QRP operation. Included with the SX-20 is the hand mike with handy UP/DOWN buttons for remote tuning of the rig while driving — or biking — or boating. Available in both fully assembled and fun to build kit form, you'll find that the SX-20 will become your favorite rig.

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Add some fun to your club events by having a transmitter hunt! Foxhunting is a craze sweeping the nation, but many clubs are missing out on the action because they lack the expertise or time to develop their own foxhunt transmitter. We set one of our most devious and sneaky engineers to the task of designing an easy to build and use, yet highly capable Foxhunt transmitter. A snazzy microprocessor controller has both preset and programmable transmission characteristics allowing you to easily set the difficulty level from "beginner" to "know-it-all"! The SlyFox, FHT-1, is crystal controlled in the 2 meter band (crystal for 146.52 included) with a power output of 5 watts that is adjustable by the controller.The transmitter is programmed to ID in CW or add our voice option if you really want to aggravate the troops - "Ha ha, you can't find me!" Join the fun, get rid of those stuffy old meetings and picnics, have a foxhunt!

DF-1 Foxhound direction finder kit	$59.95	CDF Matching case set for DF-1	$14.95
FHT-1 SlyFox Foxhunt transmitter kit	$129.95	FHID-1 Voice ID option	$29.95
CFHT Heavy duty metal matching case set for FH T-1			$29.95

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Shortwave converter kit. SC1	$27.95
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Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!

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Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.

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73 Review

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The SGC SG-230 Antenna Tuner

A longwire tuner for use on land or at sea.

Any idea what the initials "SGC" stand for? If you are an old-time ham or you got your start in amateur radio from Class D Citizens Band, you will recognize the name "Stoner" standing for the letter "S," and "Goral" standing for the "G," in SGC.

Don Stoner W6TNX pioneered premium-quality SSB CB transceivers in the early days of Class D Citizens Band, and Don's technical expertise in communications certainly owes him a spot in *Who's Who* when it comes to state-of-the-art radio designs. Don is now retired and living in Florida, and continues to take an active part in commercial and amateur radio technology.

Pierre Goral KI7UA, an active amateur operator, was the technical driving force behind SGC's development of made-in-the-USA communications products for the military, marine radio, land mobile radio, FEMA, CIA, FBI, and amateur radio services. Two-decade-old, crystal-type, marine SSB transceivers from SGC can still be found in operation, and Pierre and the entire gang at SGC, Inc., take great pride that their entire product line is designed, manufactured, and marketed right out of their Bellevue, Washington, facility in the Pacific Northwest.

The History

The SGC Model SG-230 automatic antenna coupler originally started out as a marine ATU (automatic tuning unit) to complement the many models of marine and military SGC 100-watt output SSB transceivers. The SG-230 automatic antenna tuner (also called an automatic antenna coupler) came out at about the same time Stephen Engineering Corporation came out with the SEA-1612 antenna coupler, Hull Engineering introduced a marine Model 402, and Motorola brought out their own brand and style of marine antenna coupler. But SEA and SGC were unique in the fact that their own couplers did not require a data line from a specific transceiver to switch the unit into active tuning and then lock it on tune for a specific frequency. Both the SEA and SGC couplers would tune any length of wire from 2 MHz to 30 MHz from any type of transceiver when the coupler would detect RF power input at the SO-239 jack inside the coupler.

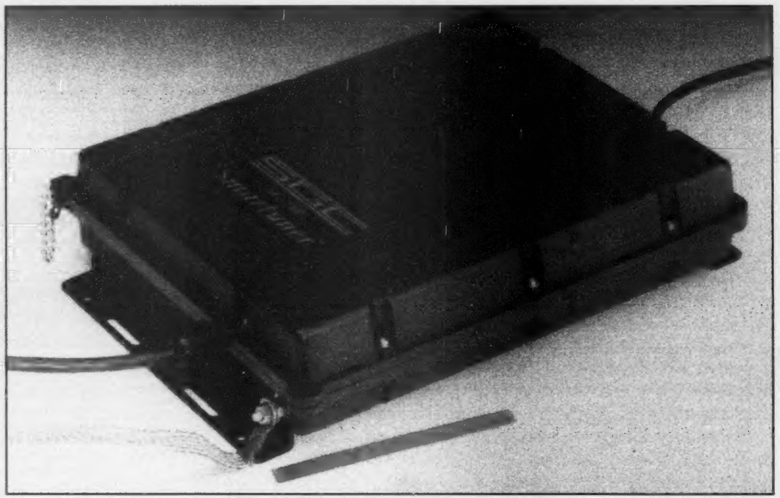
Photo A. The SGC SG-230 longwire tuner.

Here at the Gordon West Radio School, we quickly saw the possibilities of an automatic antenna coupler serving the needs of amateur operators *ashore* who wanted to resonate a longwire or loop antenna system remotely, so the tuning point was well away from the operating position, minimizing RF energy coming off of the longwire and getting back into the SSB transceiver. SEA expressed no interest in marketing their automatic antenna tuner through amateur radio distribution, and local marine radio dealers who were carrying the SEA-1612 automatic coupler had no intention of two-stepping the product into the amateur radio service. Even offers of 50- and 100-unit orders to SEA were declined, to protect the marine electronic dealers who were successfully selling this tuner at approximately $999 as a marine-only SSB automatic tuner.

When Pierre at SGC saw the potential of the SG-230 tuner for not only marine but also land applications, he was quick to establish amateur radio distribution. He now indicates that land and mobile use of the SG-230 is equal to the use of this tuner for many different types of marine SSB transceivers, and amateur land and military use are outgrowing the marine use as more and more mariners opt for satellite communications, rather than SSB stations, for ship-to-shore messaging.

"The proposed low-earth-orbit cellular-phone-like service for mariners may cause a decrease in the amount of SSB systems we put aboard large boats," comments Bill Alber WA6CAX, a marine electronics installer from San Francisco. "SSB marine radio with these antenna tuning units will continue as the 'intercom band' among mariners, but we see some boats going exclusively with satellite communications, where it might be actually easier to call the Coast Guard on satellite distress frequencies than to rely on Mother Nature for ionospheric skip calls," adds Alber. "And lately, most of my automatic antenna installations have been on land at ham radio installations," finalizes Alber.

Automatic Tuners—Big Differences

High frequency amateur radio SSB transceivers which cover 160 meters through 10 meters may indeed offer a built-in, microprocessor-controlled automatic antenna tuner.

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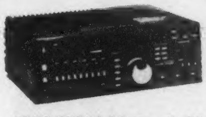

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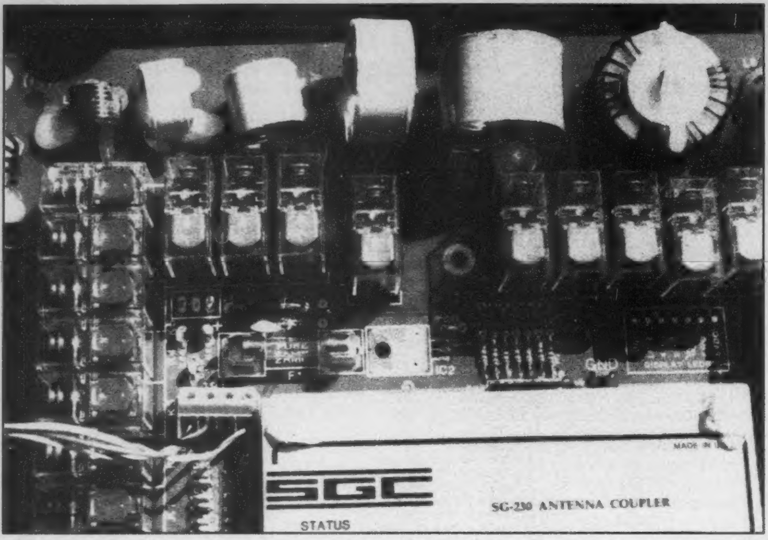


Photo B. These relays switch in various values of inductance and capacitance to resonate the tuner.

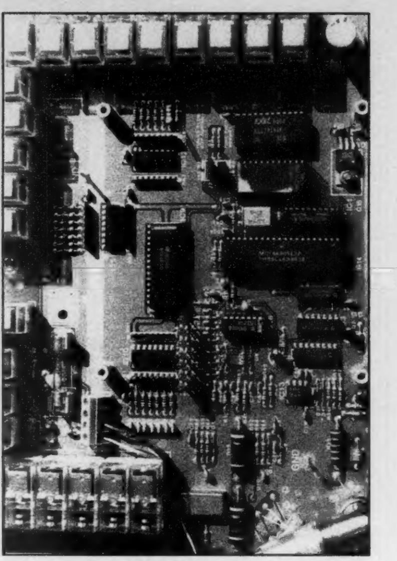


Photo C. The SGC coupler is microprocessor-driven, with active relays for minimum power loss.

The amateur radio built-in ATU (antenna tuner unit) outputs its capability to the standard SO-239 50-ohm coax antenna jack. And it's at the back of your transceiver that the ham HF set with a built-in tuner creates, most of the time, the feed point of your signal. This means the tuning process takes place right at the ham set, and what comes out of the back of the ham set is actively tuned coax up to your antenna system on the roof or on the side of your power boat, or on the stern of your sailboat, or on the top of your motor home.

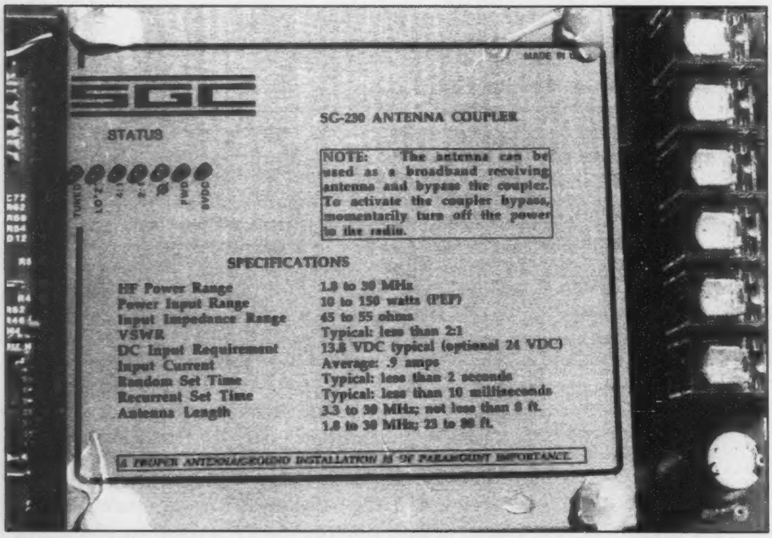
The built-in HF automatic antenna tuner is specifically designed for resonant antenna systems. The built-in HF antenna tuner works superbly in fine-tuning beam antennas, multiband dipoles, and resonant dipoles when you need to operate a couple of hundred kilohertz off of the natural resonant point.

The built-in HF antenna tuner is *not* designed to tune random wire antennas or non-resonant dipoles, and will rarely offer tuning capabilities to the typical marine installation of insulated random-wire backstays or non-resonant SSB whip antennas. In fact, most HF instruction manuals caution not to use the tuner when the antenna's "natural" SWR is above 4:1 to 1.

"The tuner goes up in smoke," comments one technician at a leading HF manufacturer who sees ATU failures when the user tries to tune up a random wire or non-resonant dipole. "Sometimes the built-in tuner will simply hunt, and then switch out of circuit, indicating no match. Other times, the tuner will sense a low SWR point, lock on, and the 100 watts output travels up the coax, bounces off of a non-resonant longwire, and back down the coax and onto the chassis of the equipment. Ultimately, the RF gets into the transceiver, and zap ..." comments the repair technician.

So use your built-in automatic HF antenna tuner for the purpose it was designed for—reducing slightly elevated SWRs when operating outside of the natural resonance of the antenna by a few hundred kilohertz. Even though the tuner may have locked onto a low SWR point on your antenna and coax system, you could be tuning up the outside chassis of your equipment and the braid of the coax as part of the entire antenna system at your shack. And you might even be getting out on the airwaves—but chances are that the longwire is not getting all of the power that it could receive from an external antenna tuner specifically designed for longwire applications.

The SGC automatic antenna tuner is specifically designed for remote mounting away from your HF amateur transceiver. In a boat, the automatic tuner goes back aft in a sailboat mooring line locker (called the lazarette), or up on the flying bridge underside to feed a non-resonant white Fiberglas whip. In mobile homes, hams have found that the SGC tuner should go in the back, up high, to feed a longwire along the roof. In homes and offices, the SGC tuner goes up at the roof line. "The automatic antenna tuner is specifically designed for use with end-fed, unbalanced antennas, such as whips and longwires," comments Pierre Goral KI7UA. "Antenna efficiency will be proportional to length, and this means that the longest possible antenna wire should be selected for the lowest frequency you plan to operate on," adds Goral. He points out that shortwires are only recommended when there is no other alterna-



NOTE: The antenna can be used as a broadband receiving antenna and bypass the coupler. To activate the coupler bypass, momentarily turn off the power to the radio.

SPECIFICATIONS

HF Power Range	1.8 to 30 MHz
Power Input Range	10 to 150 watts (PEP)
Input Impedance Range	45 to 55 ohms
VSWR	Typical: less than 2:1
DC Input Requirement	13.8 VDC typical (optional 24 VDC)
Input Current	Average: .9 amps
Random Set Time	Typical: less than 2 seconds
Recurrent Set Time	Typical: less than 10 milliseconds
Antenna Length	3.3 to 30 MHz; not less than 8 ft. 1.8 to 30 MHz; 23 to 80 ft.

A PROPER ANTENNA/GROUND INSTALLATION IS OF PARAMOUNT IMPORTANCE.

Photo D. Status LEDs on the inside of the tuner confirm that everything is working properly.

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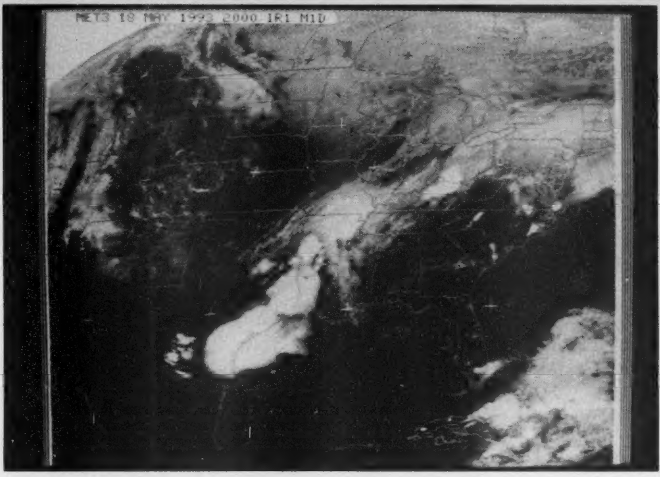

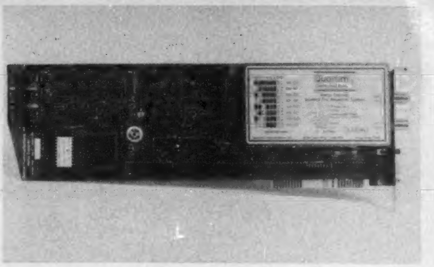

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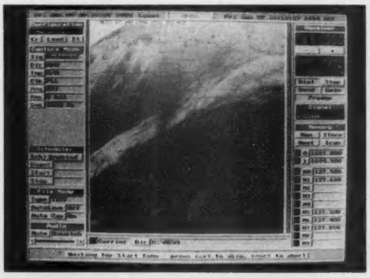

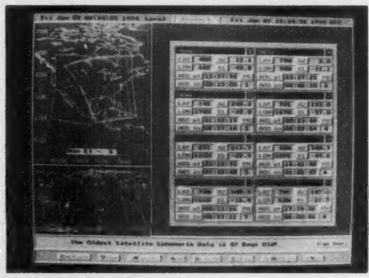

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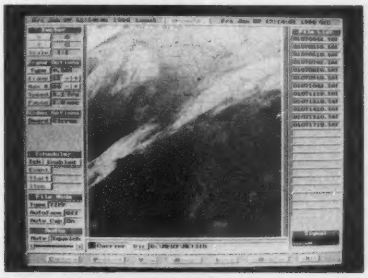

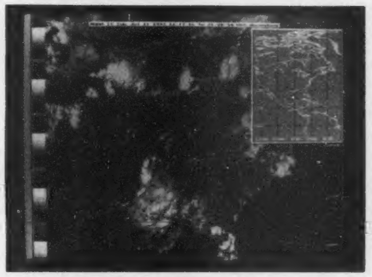

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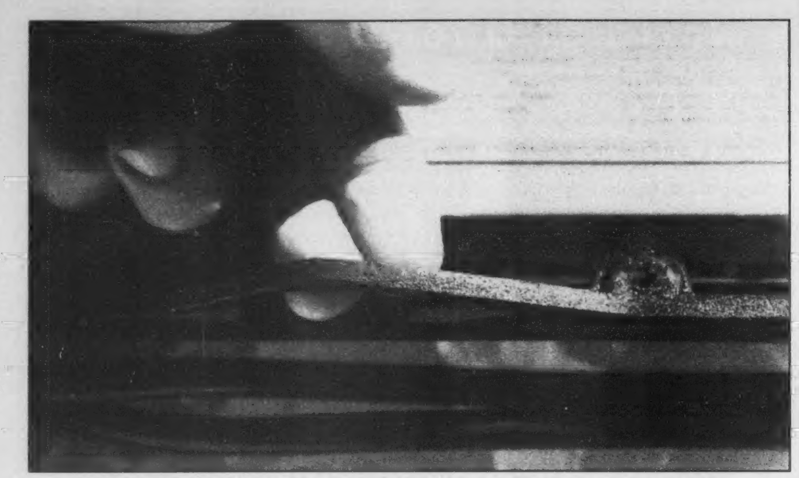

Photo E. The waterproof housing uses a gooey rubber gasket to seal out rain.

tive, such as in a vehicle mobile installation.

Part of the overall antenna system is the ground that is brought up to the base of the tuner, and for marine installations this is usually accomplished with low-inductance copper foil. In home installations and offices, the ground must be attached to chicken wire holding on stucco, or any major metal source on top of an office. In airplanes, it's the fuselage. Out on Field Day, the ground could be a nearby stream or ground foil entrenched out from the tuner an inch under the earth.

In other words, the feed point now becomes the antenna tuner itself, not right at the HF SSB ham or marine transceiver that you are sitting in front of. Not only does this minimize splash-back by the outgoing RF, but it also keeps your equipment from sounding distorted when high SWR on the line from built-in automatic tuners creeps into your microphone circuit. Won't happen with the SG-230—it creates a 50-ohm match at the feed point, and this lets the coax run "cold" from your rig to the remote-mounted tuner.

The factory only puts on 10 feet of coax with the tuner, and this is truly too short for most home, office, field, or marine installations. You will need to add additional coax, plus an additional four-conductor line that supplies 12 volts and tune-indicator/tune-freeze capabilities. I recommend using a barrel connection and RG-213 to extend the coax line. Below 30 MHz, this connection (kept bone dry) won't amount to any significant dB loss. You are probably thinking it would be better to run the RG-213 directly into the tuner box to replace what's already provided, but if you try that, you break the weather-tight seal on the tuner, and you then quickly find out that it's a hard-wire connection that would be difficult to accomplish easily with bigger coax. Use the coax jumper and weatherproof the connection point, and save yourself from grief!

The four-conductor line that is part of the original SGC coax assembly has a red and black wire for 12 volts. Sixteen-gauge is fine as an extension because the tuner only consumes about 900 milliamps during active tuning, and half that when it is locked on. The actual current will vary slightly, because the microprocessor may have few, some, or many of the relays engaged. I don't think I have ever seen an SGC pull more than 1 amp.

The other two white wires with color tracers are for an accessory "in-tune" LED, as well as an accessory tune lock capability designed primarily for mobile installations. The remote-tuned indicator line goes low to ground when the SG-230 is tuned. This means you hang a diode off of the red wire to the white wire with a black tracer, to illuminate when the tuner has found an optimum tuning. I don't use the LED—I just look at my transceiver, and when I see the power indicator go all the way over to 100 watts output, I know that the tuner has achieved "tuned." If the tuner isn't tuned, the modern HF amateur transceiver will show next to nothing for power output, and this is an indication that you forgot to turn on the 12 volts that lets the tuner do its thing.

The other white wire with a red tracer is for an accessory "SmartLock" controller that is sometimes necessary to keep the tuner locked on when tuning a non-resonant whip in a mobile installation. On lower ham bands, the tuner is constantly seeing a varying impedance on the whip as it swings around on the vehicle, and this lock-up feature freezes the tuner when the best match has been found with the whip relatively motionless. But since we don't recommend a short antenna being remotely tuned with this tuner for mobile installations, you won't need to worry about this extra wire.

Indeed, SGC makes this tuner for mobile units, but you'll get "zip" performance if trying to tune a stainless steel mobile whip with the tuner in your trunk. You would do better to run pre-tuned whips and keep the tuner out of line. The tuner is not designed for tuning anything normally fed with coax cable. In fact, trying to run coax on the tuner output will lead to a no-tune situation because of the high capacitance shunt to ground. "Every foot of coax represents 29 picofarads, and 29 picofarads to ground can represent a large loss," explains Goral. About the only type of whip that could work with the SGC coupler is the very special high-current helical whip Model 303 that SGC offers with the mobile SGC quick-mount system. This puts the tuner into a big metal box that hangs on the side of a vehicle, and the whip from SGC (Model 303) protrudes out of the mount and stands about nine feet tall. It's a relatively good-performing system, but only an amateur operator could appreciate what it looks like on the side of a new car.

Typical Installations

To calculate how much coax and two-conductor power lead you might need, consider the following "typical" amateur radio installations.

Tuner back aft in a sailboat, feeding an insulated backstay antenna: The separation is 15 to 30 feet, and you'll need about 50 feet of copper foil to complete the ground connection. You will need about 15 feet of GTO15 high-voltage single wire with plastic insulation to feed the output of the insulated portion of the backstay.

Home installation with a tuner in the attic: This could be 20 feet to 75 feet away and up. Plastic-coated, stranded copper wire is the radiator, typically run along the horizontal beam in an attic. The tuner is mounted to the side of the house wall, and picks up chicken wire for a good counterpoise ground to the earth.

Tuner mounted on top of an industrial building—up to 150 feet away using Belden-style 9913 coax for the extra long run: Use 14-gauge for the extra long power run. Single wire 60 to 300 feet long runs in the clear on the top of the roof. Keep it away from metals, and make sure it's plastic-coated to ensure

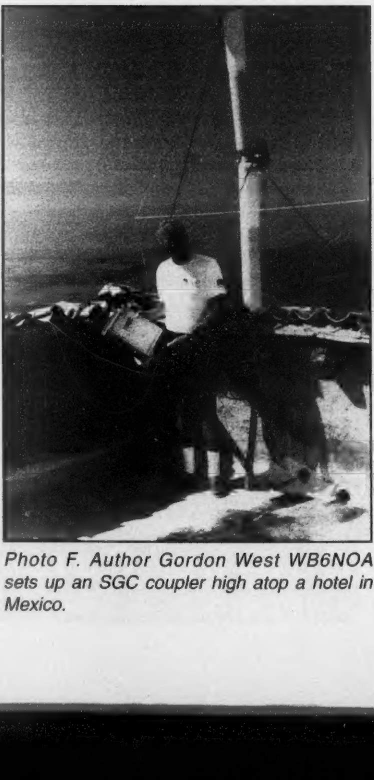

Photo F. Author Gordon West WB6NOA sets up an SGC coupler high atop a hotel in Mexico.

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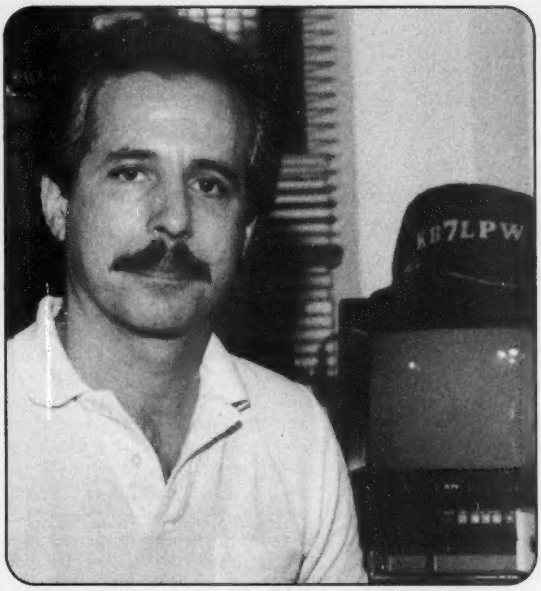
National Talk Radio Show With Len Winkler, KB7LPW



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MA:	WNBH	1340 am	NEW BEDFORD/PROVIDENCE
MA:		BOSTON CABLE CHANNEL 38B	
MI:	WMKT	1270 am	TRAVERSE CITY/CADILLAC
MO:	WBGZ	1570 am	ST. LOUIS
MO:	KSLQ	1350 am	WASHINGTON
MO:	KNWA	1600 am	SPRINGFIELD
NC:	WCRY	1460 am	RALEIGH
NC:	WEEB	990 am	FAYETTEVILLE
NC:	WSKY	1230 am	GREENVILE/SPARTENBURG
NE:	KICS	1550 am	LINCOLN
NM:	KICA	980 am	AMARILLO
OH:	WIOI	1010 am	CHARLESTON/HUNTINGTON/ NEW BOSTON
OK:	KADS	1240 am	OKLAHOMA CITY
OK:	KTMC	1400 am	MCALESTER
PA:	WJMW	550 am	SCRANTON/WILKES BARRE
SC:	WPCC	1410 am	CLINTON
TN:	WRWB	740 am	KNOXVILLE
TX:	KIVY	1290 am	CROCKET/PADDINGTON
UT:	KTKK	630 am	SALT LAKE CITY
UT:	K26EM	CHANNEL 26TV	EMERY COUNTY/ CASTELEDALE
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Photo G. The auto-tuner QMS-mounted on an off-the-road vehicle.

that it doesn't arc over to anything metal. The tuner grounds to metal flashing on the roof, or to anything "major metal" on the top of the roof.

Tuner mounted on metal ham radio tower: Short braid grounds the tuner to the tower as a counterpoise. The longwire from the tower goes over to a big tree 60 feet away, and then goes to other growing things on your property. Use insulated wire. You wouldn't think of running it over to your neighbor's tree, would you?

An installation challenge—no ground on top of a wood office building: No problem—run 6 to 8 turns around the office with 16-gauge or larger wire. Start with the high-voltage antenna output, and terminate to the tuner's own ground. This loop antenna represents a DC short circuit, but works great on HF. It has very low noise. Make sure the radio is well grounded to keep the mike from biting you.

Recreational vehicle, tuner mounted up high along the roof line: Plastic-coated wire on 18-inch PVC standoffs run around the Fiberglas roof. The tuner grounds to a metal chassis with foil or braid. For metal-roofed mobile homes, try this and see how it works. You may do better to take the longwire and throw it over a nearby tree when you're out camping.

Using the automatic tuner like a dipole: Use random-length wire going one way from the antenna post, and random-length wire coming off the ground post going in the opposite direction. Make sure the radio is well grounded in this installation.

Tuning up a flagpole set in concrete: If you can find or initiate an installation where the aluminum flagpole is isolated from the metal structures inside the concrete, all the better. The tuner hides at the base. Single wire goes to the flagpole, and foil attaches to a suitable ground plane in the concrete. For safety, insulate the metal portion of the flagpole where anyone might touch it accidentally, or dogs could water it. Fly Old Glory with a nylon pulley, and be patriotic while working HF.

In the SGC tuner manual, they give additional tips on how to run the automatic coupler for interesting results. Experiment, experiment, experiment!

How It Works

When you apply 12 volts DC, the insides of the antenna tuner snap to attention with an audible click. The tuner uses super-quality relays to engage various amounts of inductance and capacitance to resonate the antenna system. Everyone worries that the relays will go bad in the marine environment, but their gold-plated contacts and their operation have proven reliable, with relay failure being almost zero on the technician fix-it reports.

The tuner receives its command to begin the tune-up process by your simply speaking into the microphone on your SSB transceiver without the need to push any transceiver buttons, or the need to switch to CW or AM. Simply say, "FFFFF OOOOO UUUUU RRRRR" for about two seconds, and that's it. Do it on the highest frequency desired, and then the lowest frequency desired, and listen for a clattering of the PC-mounted relays. As the SGC automatic coupler begins its tune-up process, it begins to learn your antenna's requirements and stores this information in a chip memory system that is capable of memorizing hundreds of individual frequency/relay combinations—very useful when operating on 40 meters, 75 meters, and 160 meters, where a slight change in frequency will necessitate new values of L and C to be relay-switched into the circuit.

A detector device in the SG-230 monitors the antenna system impedance, reactance signal, and the VSWR load when you say "FFFFF OOOOO UUUUU RRRRR" into the mike. The computer inside the tuner uses the spoken word to detect power across six capacitors in shunt on the input arm of the network, arranged in binary increments; eight inductors in the series arm, arranged in binary increments; and five more capacitors in shunt on the output arm. Relays are provided in conjunction with each lumped constant and allow removal or entry as desired. A network having 64 values of input shunt C, 32 values of output shunt C, and up to 256 values of series L is possible with the internal 26 relays (C for capacitance, and L for inductance).

A tune-up algorithm which is contained in the memory of the computer system inside the SGC actually implements the antenna matching. The computer is designed around the C-Moss MC146805E2 CPU which features a versatile instruction set and an on-chip timer and RAM. The antenna coupler relays are controlled through IC9, a MM5480 decode/driver. The MM5480 is used as a serial-to-parallel interface port, and the clock and data inputs of the MM5480 are driven from CPU ports PA1 and PA0, respectively.

The tuner monitors the status of the input sensors and, starting from a preset condition baseline, manipulates the RF elements L and C through its control algorithm, resulting in a correctly tuned condition. When tuned, your radio sees 50 ohms, for maximum power output. The typical tune process takes about 20 milliseconds once the tuner has recognized a specific length of antenna wire and a suitable ground. If the wire and ground system remain unchanged, the tuner won't go through the one- or two-second "clatter" search.

While the optional light-emitting diode circuit may illuminate an LED that the tuner has found tuned, you can easily tell by monitoring the output power of your transceiver when you say the magic word "FFFFF OOOOO UUUUU RRRRR." As you speak into the microphone in your QSO, your power output will continue to register full. Whether you view power output on your transceiver as colored LEDs, or as a meter movement, there is no mistaking that the tuner is radiating the signal and giving your set a thumbs-up 50-ohm load.

For shortwave listening on the general coverage high frequency band, you can tune the tuner to the 30 meter ham band and enjoy great reception from 4 MHz to 18 MHz, going through the pre-tuned settings. If you want to bypass the tuner settings, simply remove the 12 volts, then turn it back on, and the tuning elements remain out of the circuit until the tuner is activated by your transmit signal.

Features

2 MHz to 30 MHz continuous operation
150 maximum watts input SSB
Input impedance—45 to 55 ohms
Input VSWR after tune-out—less than 2:1
DC requirement—13.8 VEC
Input current—900 miliamps
Antenna length recommendations—25 feet to 100 feet, 3.5-30 MHz; 50 feet to 200 feet, 1.8-30 MHz
Installation—any position
Size—16" x 12" x 3"
Weight—8 pounds
Case—ABS weatherproof plastic
Control cable—9 feet coax and 4 power/tune wires
Instruction manual—included; first half non-technical, second half very technical, available for $10, refundable with factory purchase of tuner
Distribution—dealers or direct for export
Technical service support—excellent; write or call the factory.
Amateur operator feedback on SGC technical assistance and repair—overwhelmingly positive comments when repair or technical advice was needed. Easily reached by phone, with immediate follow-up always.

There are jumpers inside the tuner that could drop the tuning elements out of the circuit for receive, but I recommend leaving these jumpers alone and not breaking open the tuner case. Unless you're operating in a frequency-hopping scheme, use the tuner straight out of the box as it comes from the factory.

And how well does it work? Aboard boats, better than mobile whips on a stainless steel rail in establishing contacts beyond 2,500 miles. Within 2,500 miles, both mobile whips and the tuner work fabulously. In most home installations and office buildings, an extremely long wire will do as good as, if not better than, pre-cut dipoles. Just be sure to keep the active antenna element as far away from noisemakers as possible. For home installations, watch out for TVI, too. Since the wire is so long and so hot with RF, it can easily get into home electronics when it's draped over a roof line.

Will the longwire work better than a beam? Hardly. Maybe for close-in, high-angle radiation contacts, but nothing beats a beam. Will it work better than a roof-mounted trap vertical? Very comparable, but without the sight of a big, tall vertical on the roof. Will it work mobile with an extremely short CB-type whip? Hardly. For mobile applications, SGC has a special model and a special whip.

Will the tuner work better than solid-state toroidal inductive matching networks? Infinitely so! I don't need to tell you what's inside those passive antenna networks sold for hundreds of dollars. Ask the X-ray machine at *QST!*

Out here in Southern California where antenna restrictions are common in new housing developments, the SGC automatic antenna coupler is an effective way of putting out a powerful signal from an antenna system that will go unnoticed by your neighbors.

The SGC Model SG-230 antenna tuner carries a marine retail price around $600, but can be seen selling in the amateur radio market new for approximately $450. If you are looking for something fun to play with this summer, the SGC Model SG-230 antenna tuner is a real RF workhorse. ■

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The KK-1 from AEA

The perfect keyer.

Have you ever had the perfect ham accessory and then lost it somehow, never to find it again?

I think that each of us has, at some time, had the most wonderful ham-related item and then sold it, traded it, or broke it, losing it forever. In my case, the perfect CW keyer crossed my path about 10 years ago in the form of the Heathkit CW keyboard. It performed flawlessly. With a large type-ahead buffer, soft sectored memories, and the easiest operation possible, it became a good friend until, in a fit of poor judgement, I sold it.

I didn't see one again until I ran into the new AEA KK-1 keyboard. I say this because the new AEA keyboard was designed by Terry Perdue K8TP, the same engineer who designed the Heath keyer. The similarities are profound. There is no doubt about the family lines: 255-character type-ahead buffer, soft sectored memories, small number of function switches, etc. So I was very happy to discover the new nephew of my old friend and promptly acquired one.

The KK-1

The newest product from Advanced Electronic Applications comes in a small, 173mm x 114mm x 64mm, package that needs only an AT-style keyboard and a 12 VDC power supply. The keyboard can do double duty with your station computer. This was a design element in engineering the keyer, as the unit comes with a cable to connect your PC keyboard to both the computer and the keyer. Using a simple keystroke, you can switch from CW keyboard to your computer logging program, or whatever program you routinely leave running on the shack computer. The 12 VDC can be supplied from a simple plug-in brick, your shack supply, or even a battery.

The only apparent control is a large knob that is used to set the sidetone or the keyer speed. The speed is more easily controlled by keyboard entry, however. And speaking of speed control, this unit is the only one I know of that lets you use any combination of keying speed and spacing. Using this feature, you can set it up to use Farnsworth keying or any combination that suits your fancy. By using the shift key and the arrow keys you can set the speed and spacing while watching the digital readout. This green display is the only other thing on the front panel other than the knob. By the way, the keyer is shaped like a long wedge, giving you an attractive sloped front and a large rear panel that has all of the connectors necessary for hooking up the keyer.

The KK-1 keyer from AEA.

The rear panel has a power supply connector, keyboard input and output (to connect to your computer), paddle input, outputs for normal keying or grid-block keying, an on/off switch, a headphone connector, and volume control. Use a 1/4" phone plug to plug in your favorite iambic key. At any time while you are operating you can change over to manual keying just by using your key. If you are not handy at typing, this may be a great feature for you. For the slow typist, you can, at your leisure, type in all the data you want, assign message ports, and then in a QSO switch over to manual keying.

The Memories

The memory is almost 8K and can be divided up into 12 message centers. You can even link one message to another. You can tell one memory to switch to another at a certain time in the keying sequence. The programming only allows one level of nesting, but this shouldn't be much of a problem to the average user. The keyer also allows you to send serial numbers for those contests that use that system of exchange. Eight K doesn't sound like much memory until you try filling it up. It really is a lot of memory for the average ham.

The memories are set up using the function keys on the keyboard. With a typical AT board you have 12 F-keys, and thus 12 separate memories. A typical station setup would put a CQ sequence in one memory, "your RST is" in another, and then your QTH, etc., in another. I use the last two functions keys for identification purposes. One sends "de WM4U K" while the other sends just my call.

Using the Keyboard

This is a very fancy memory keyer, but one using the keyboard as an input device, allowing you to send perfect code every time. Using a keyboard makes it very easy to operate CW and gives those on the receiving end perfect copy on their multimode controllers.

Now why should you go with a dedicated keyboard instead of using a multimode unit? The biggest reason is simplicity. You don't need to have a video display or to know any complicated operating sequences. This also frees up your computer for use as a dedicated packet DX cluster monitor, logger, etc., but still leaves you with perfect CW at your fingertips with no program changing.

I've been using my keyboard for over a month with no problems whatsoever execpt for two things (always a catch, eh?). One small complaint is that the unit produces a small amount of computer hash, most noticably on the bottom end of 20 meters. The last memory keyer I owned produced so much noise it made 20 meter CW nearly impossible, but this unit has minimum noise in comparison.

The other quirk I have encountered is in the choice of keyboards. I bought a new keyboard at the same time I purchased the keyer, and for a long time I noticed no problem until I got on 80 meter CW. At this point I was ready to toss the keyer out the door. It locked up at times, sent random CW with no input, sent crazy things from the memories, and was just plain useless. Turns out the problem is not with the keyer but with the keyboard I bought. It is very, very susceptible to RF on 80 meters. I tried two other keyboards and found that my old Tandy keyboard would take any amount of RF and keep on doing its thing with no problems at all. However, the new keyboard would not work on the computer. Now, on to my other computer, which is a Magnavox 386. That keyboard would not operate the keyer. It would send just four characters, and four only. So much for the AT-style keyboard being a random selection item. You'd better check out your keyboard with the unit before settling on it as a permanent investment.

Specifications

Character formation 5-90 wpm
Sending speed range 5 wpm to formation speed
12 memories
Keying output positive to ground and grid-block
Serial numbers 1-9999
Message auto-repeat delay 1-99 seconds
Dot-dash ratio (weighting) Normal plus 9 light and 9 heavy settings
255-character type-ahead buffer
Message capacity 7913 characters
Sidetone range 200-2500 Hz
Power requirement 10-16 VDC at 350 mA

KKCOM for Easy Programming

For those of you who want an even easier way to program your KK-1 keyer, AEA now has a software/hardware package to facilitate loading the memory buffers. Called *KKCOM*, the package consists of software supplied on both 3.50" and 5.25" floppies, and what at first appears to be a simple cable with a 1/4" stereo plug on one and and a 25-pin computer connector on the other. However, inside the 25-pin connector is a small circuit board with 10 components on it: four transistors, five resistors, and a diode. This circuit forms an interface between your computer and the KK-1 keyer. The 25-pin connector goes to your serial port, and the stereo plug goes into the keyer where the paddles normally connect.

The software makes it possible to display what you are typing into the 12 memory buffers. These message centers can then be uploaded into the KK-1 keyer with the proper command. The current contents of your keyer memories can also be downloaded into your computer for storage and/or modification. In addition to memory management, you can also change your keyer speed, sidetone, spacing, etc., from your computer.

To use the KKCOM system your KK-1 must have version 2 or later firmware. AEA has certainly been busy making ongoing improvements with their keyer, as they have been changing the firmware faster than most of us change (your choice of cliche here).

The current retail price of the KKCOM is $49 and it comes with complete documentation, interface, cable, and stereo plug. If you want to update your KK-1 keyer from version 1 to version 3 it will cost approximately $75; from version 2 to version 3, $65.

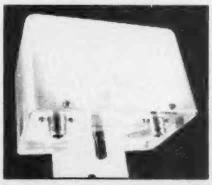
Other Features

Other features of the KK-1 are 19 settings for weighting, auto-repeat delay, adjustable sidetone, and CW practice. Unlike its little brother, the MM-3, this keyer can't carry on conversations with you. However, we're on the simplicity of operation bandwagon and this certainly fits the bill. There are certain keys on the keyboard that do special functions such as send CQ or "de," or send procedural signs such as KN and SK with a single keystroke, plus TUNE. One item that would be very useful would be an overlay with these keys marked. Perhaps that will be an item for the entrepreneurs to come up with.

The keyer is warrantied for one year and has a suggested retail price of $199.

Its simplicity of operation and the dependability of AEA products in general make this a keyboard keyer that will fill a niche in the shack. I'm definitely not going to sell this one!

HIGH POWER RF SWITCHED PREAMPS



Model 146
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Model 440
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Model 146 160W 2 Meters 19db Gain .75db Nf
Model 146OS 160W 2 Meters 19db Gain .75db Nf
Model 440 70cm 100W 16db Gain .75db Nf

All preamps have helical filters to prevent out of band intermodulation in the receiver. Model 146 covers the entire 2 meter band. Model 146OS is of very narrow bandwidth and would be suitable for SSB. Packet, or Satellite. Model 440 is factory tunable from 430–440 MHz or 440–450 MHz per customer request. All models are powered with 13 to 20 VDC and are mounted at the antenna.

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CIRCLE 273 ON READER SERVICE CARD

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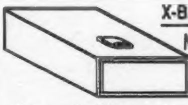

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Battery Monitor and Charger Controller

by Marion D. Kitchens K4GOK

Many hams have a 12-volt automobile battery under the operating table for a variety of uses. There is a continuing need to know the battery voltage and to keep it charged. A hassle-free means of solving these two problems is offered by the battery monitor and charger controller described in this article.

This unit displays the battery voltage on a 10-segment bar LED in increments of 0.5 volts over the range of 10.0 to 14.5 volts. When the battery voltage drops to 12.0 volts the unit automatically enables the 110 VAC line to the charger and begins charging the battery. As the battery voltage rises to 14.0 volts, the unit disables the 110 VAC line, turning off the charger. A discrete LED provides a visual indication of the on-off state of the charger. The 110 VAC line control is all solid state, eliminating mechanical relays and the inevitable pitting and dirty relay contacts. The circuit automatically switches to the "Charge" condition upon application of 12 VDC to the unit.

A printed circuit board layout is provided (see Figures 2 and 3) for builders who desire to make their own. Etched and drilled boards are available from FAR Circuits (see the Parts List) as well. The circuit is simple enough to be easily built on perf board, as a prototype was. It is easy to build and has no tricky circuits or difficult adjustments. All components are readily available at most of the mail order supply houses such as Digi-Key, or from "Peg Board" sources such as JimPaks. The unit is configured to occupy minimal shelf space on a crowded operating table, while presenting the display for easy visibility and power connections near the rear of the table. This results in the long, narrow configuration shown in the photos.

The Circuit

The schematic for the battery monitor and charger controller is shown in Figure 1. The circuit senses the 12V battery voltage and applies it to the input of the LM3914. The LM3914 converts the analog input voltage to 10 discrete outputs, each of which drives a segment of the bar LED. The LM3914 in this unit is wired as an expanded-scale voltmeter so that the first LED lights when the input is 10.0 volts and the last LED lights when the input is 14.5 volts. Thus, the various LEDs light following the battery voltage as it discharges and is recharged. The bar LED provides the battery voltage monitoring function.

The 4011B quad gate is wired as a set-reset flip-flop. The "set" input is connected to the "12.0V" LED pin of the LM3914, so that the 4011B output is set high when the 12.0V LED lights. The "reset" input is similarly connected to the "14.0V" LED pin of the LM3914. When the battery voltage reaches 14.0 volts the 4011B output is reset low. The 4011B output drives the MOC 3010 optoisolator, turning it on and off as the battery voltage ranges between 12.0 and 14.0 volts. The MOC 3010 in turn operates the triac, which switches the 110 VAC on and off to the battery charger. Two gates of the 4011B are wired to control a discrete "charge" indicator LED, in an identical set-reset manner. Note that the 4011B has inputs and outputs wired

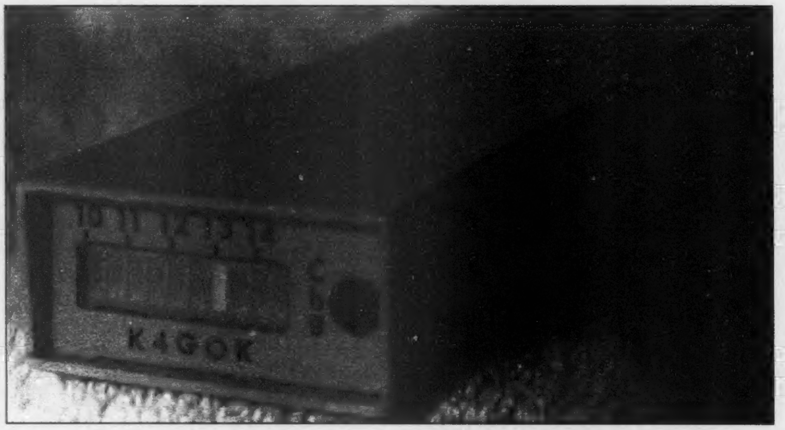


Photo A. Completed battery monitor and charge controller unit.

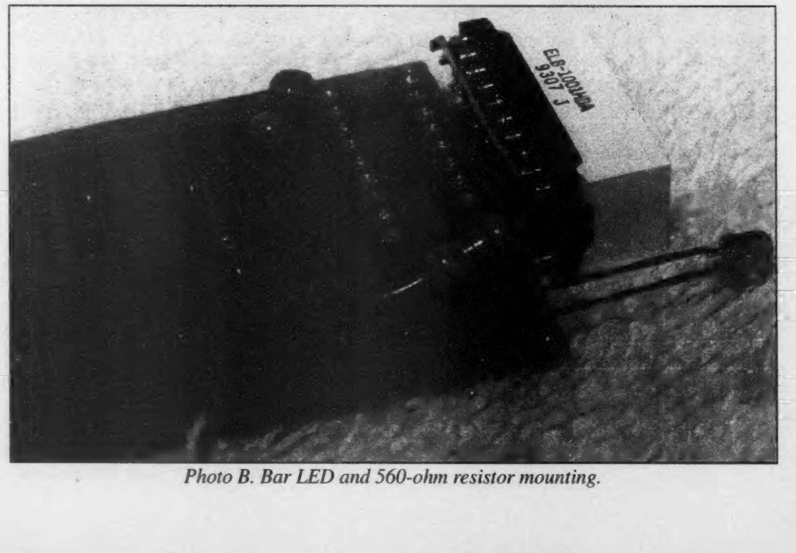
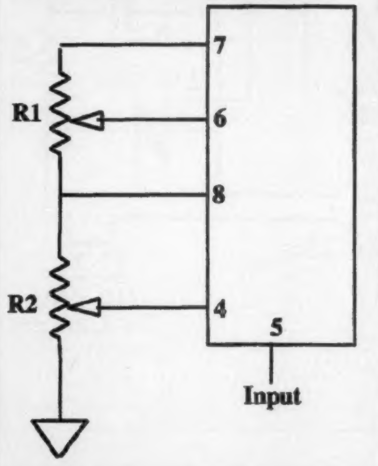


Photo B. Bar LED and 560-ohm resistor mounting.

Design Equations And Principles For The LM3914, 15, & 16 Chips

Reference Circuit 1



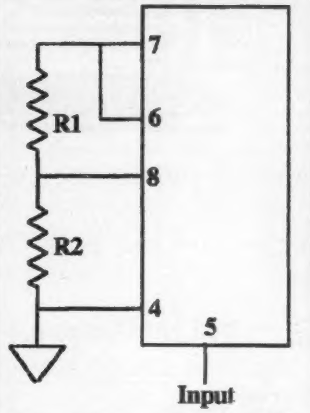
Principles:

1. The chip maintains a constant 1.25V across pins 7 and 8.
2. The current thru each LED is determined by the resistance between pins 7 and 8.
   Current =12.5/R1
3. Current thru R2 is the same (close) as R1.
4. Pin 6 is the top of an internal precision resistor chain, and pin 4 is the low end. This chain is connected to the internal comparators, and is compared with the voltage at pin 5 for determining which LED to light.
5. The #10 LED lights when pin 5 voltage is that on pin 6. The #0 LED lights when pin 5 voltage is that on pin 4.

Design Notes:

1. The voltage across R1 is always 1.25 ±.03
2. The voltage across R2 is always...
   $V_{R2}= (R2/R1)(1.25)$
3. The sum of voltage across R1 and R2 can't exceed the supply voltage, naturally!
4. Maximum voltage at pin 6 (wiper at top) is $V_{R1}+ V_{R2}$
5. Minimum voltage at pin 6 (wiper at bottom) is V_{R2}
6. Maximun voltage at pin 4 is V_{R2}
7. Minimum voltage at pin 4 is zero (ground).
8. Chip to chip variations cause minor voltage variations

Reference Circuit 2



Design Example - Circuit 1

R1 = 1.0K, R2 = 5.0K
LED current = 12.5/1.0K = 12.5 ma
Max V_4 = (5.0/1.0)(1.25) = 6.25 volts
Min V_6 = 6.25 volts (same as above)
Max V_6 = 6.25 + 1.25 = 7.50 volts

Design Example - Circuit 2

Zero to 5 Volt Meter (V_6 = 5.0, V_4 = 0.0)
LED Current = 10ma
R1 = 12.5/.010 = 1.25K
V_{R2} = 5.0-1.25 = 3.75
R2 = (3.75)(1.25)/1.25K = 3.75K

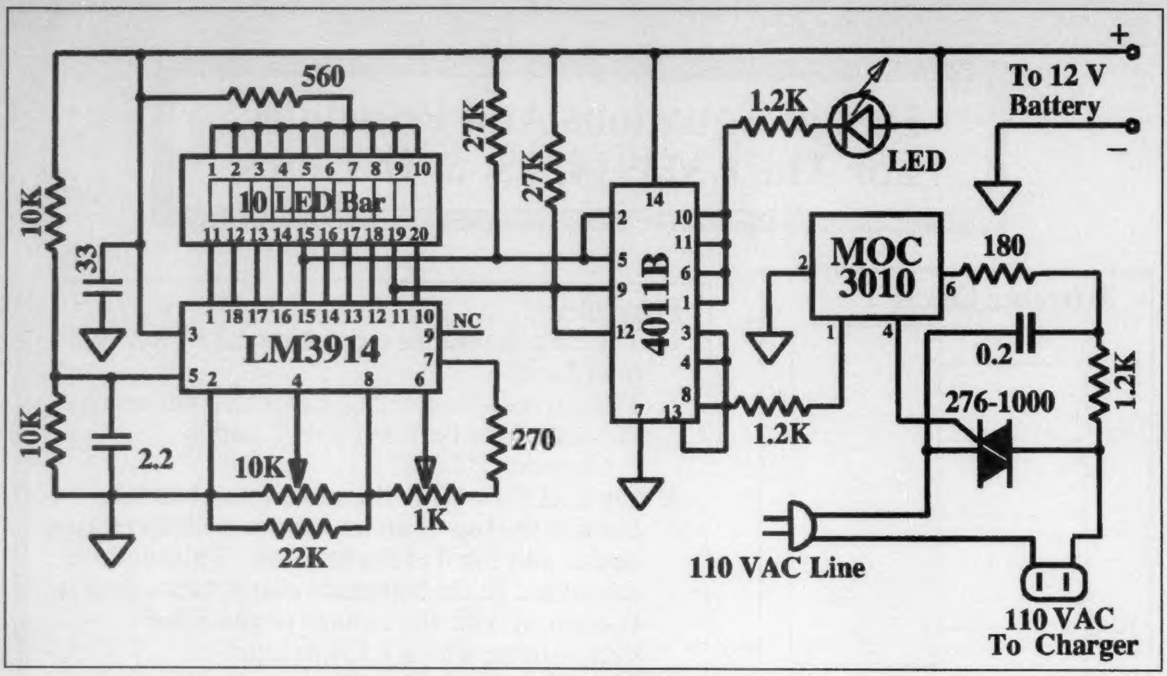

560
10 LED Bar
1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19 20
LM3914
1 18 17 16 15 14 13 12 11 10
3
5 2 4 8 6
9 7
NC
10K
33
10K
2.2
10K
22K
1K
270
27K
27K
4011B
14
2 5 9 12
10 11 6 1 3 4 8
7 13
1.2K
LED
1.2K
MOC 3010
2 1 6 4
180
0.2
1.2K
276-1000
+
To 12 V Battery
–
110 VAC Line
110 VAC To Charger

Figure 1. Battery monitor and charge controller schematic.

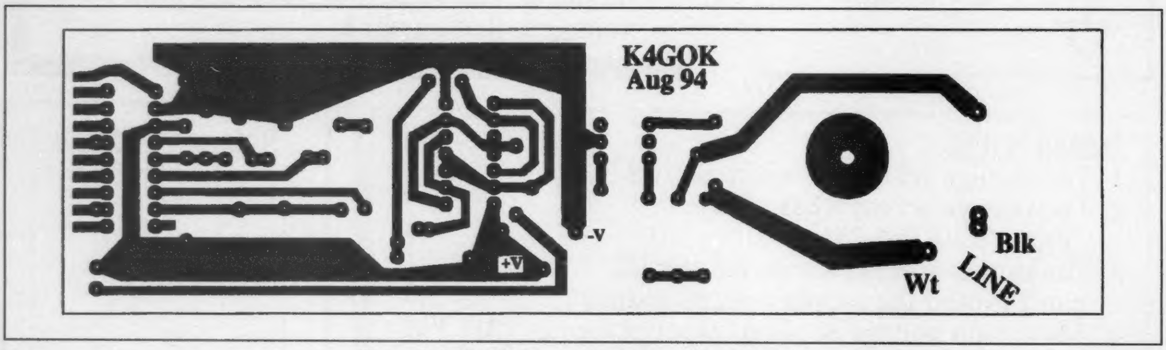
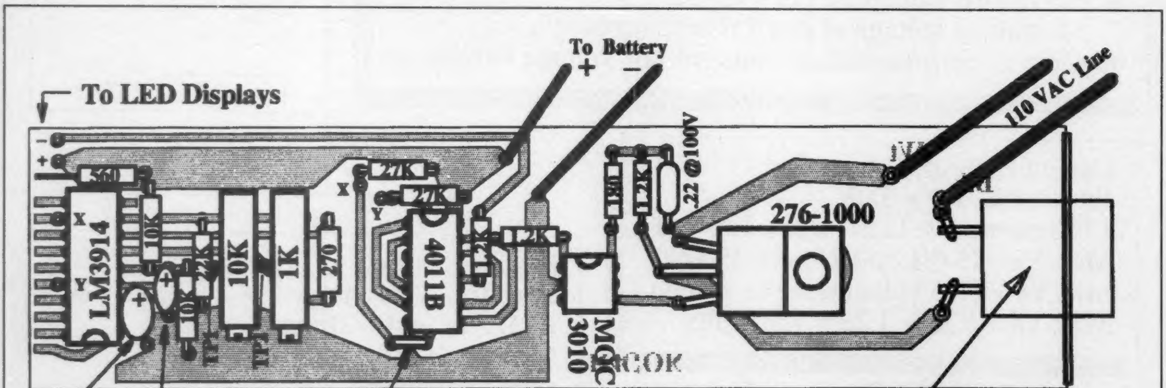

K4GOK
Aug 94
-V
+V
Blk
Wt
LINE

Figure 2. PCB foil pattern (view from copper foil side).


To LED Displays
To Battery
+
–
110 VAC Line
560
LM3914
X
Y
10K
10K
1K
270
27K
27K
4011B
1.2K
180
1.2K
.22 @100V
276-1000
MOC 3010
TP
TP
K4GOK
33 MFD
2.2 MFD
JUMPER
Connector To Charger (110VAC)

SEE TEXT & PHOTOS FOR DISPLAY MOUNTING
CONNECT POINTS X-X & Y-Y WITH JUMPERS

Figure 3. Parts placement drawing.

in parallel to provide the necessary drive to the other circuit elements.

Construction and Checkout

Construction is rather straightforward when using the PCB. The PCB foil pattern is shown in Figure 2. Install all the IC sockets, resistors and caps as shown on the parts placement drawing, Figure 3, except for the 560-ohm resistor. Sockets are recommended for all of the ICs except the triac, which should be soldered in place. Bolt the triac to the PCB for good thermal conduction. Observe proper polarity when installing the 2.2 and 33 MFD tant caps. Note that there are three jumpers on this PCB. One is near pin 7 of the 4011B and is installed from the component side of the board. The other two are installed on the foil side of the board, and go between the points marked Y-Y and X-X, as shown on the parts placement drawing.

The LEDs should be installed next. A socket for the 10-segment bar LED is recommended. Note that the bar LED socket is mounted 90 degrees to the PCB surface. Solder the socket directly to the edge of the PCB. The resistor lead should be soldered to all the socket pins along one edge, as shown. Study the photo to see how the socket and the 560-ohm resistor are mounted. Solder in place the "charge" LED with lead lengths so that it will extend through the front panel.

At this point the PCB should be carefully inspected for solder bridges. Check that all points that should be connected to 12V are, and that everything that should be connected to ground is. Verify that there is no short between 12V and ground. Be careful checking this circuit because potentially dangerous voltages will be present before checkout is completed. Make sure no 110 VAC is connected for the moment. Remove any voltage on the two caps by temporarily shorting across them at the cap leads. Connect an ohmmeter between test point 1 and ground, and adjust the 10k pot for a reading of 4.9k. Adjust the 1k pot for an ohmmeter reading of 7.2k between test point 2 and ground. Pay careful attention to the proper orientation of the ICs and install them. Briefly apply 12 VDC power and verify that the "charge" LED lights. One segment of the bar LED should also light at this time.

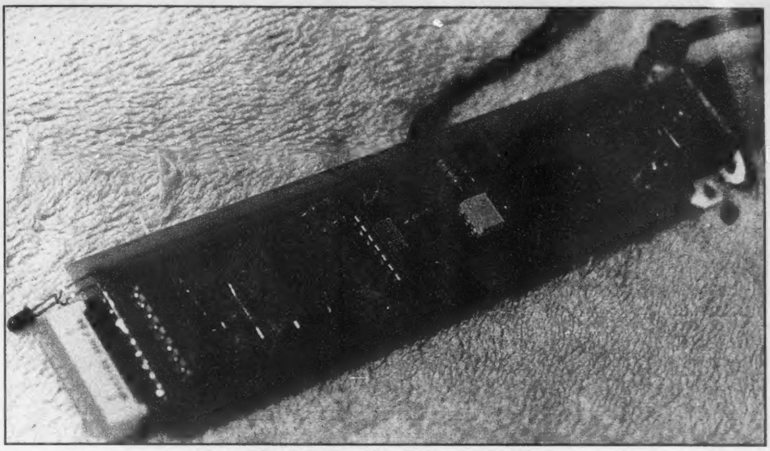


Photo C. Completed circuit board.

Next power the PCB with a variable voltage DC supply that will cover the range from 9 to 15 volts. Set the power supply at about 12 VDC. Adjust the 10k pot for 4.90 volts at test point 1 (TP1), then adjust the 1k pot for 7.25 volts at TP2. Set the power supply to 14.5 volts output, and fine-tune the 1k pot so that the "14.5V" LED just lights. The "14.5V" LED will be the rightmost one when the PCB is component-side-down. Then set the power supply to 10.0V and fine-trim the 10k pot so that the "10.0V" LED just lights (the leftmost LED with the PCB upside down). Repeat these adjustments until the "14.5V" LED lights just as the supply voltage rises to 14.5 volts, and that the "10.0V" LED lights just as the supply voltage falls to 10.0 volts. Note that there may be some interaction between these two adjustments.

During the above calibration, the "charge" LED should light when the voltage falls to 12.0 volts, and should go off when the voltage rises to 14.5. It is necessary to apply 110 VAC to make the next checks. Use appropriate caution. Connect your charger or a 110V low-wattage light bulb to the unit. Connect the unit to the 110 VAC line. Vary the DC power supply voltage and verify that the charger or lamp come on and go off at 12.0 and 14.0 volts, respectively. Remove the 110 VAC and check for heating of the components. Nothing in this unit should be hot after operating for several minutes. *Do not* check for temperature effects with 110 VAC applied to the unit.

This completes checkout of the unit. It is ready for mounting in a small container. A container can be made from copper-clad PCB material. It is important that the PCB be mounted in the container with the components downward for proper reading of the LED display. The "charge" LED will be on the right when the board is properly mounted. Figure 4 shows how the battery monitor and charger controller are connected to the battery and charger. Note that the 12V battery connections for the monitor and charger controller should be connected directly to the battery terminals as shown. The sidebar on page 33 contains design principles and equations for readers who might want to apply the LM3914 in other applications.

Conclusion

The battery monitor and charger controller has been in use at this QTH for many months. It serves its intended purpose well. The automobile battery under the operating table stays charged automatically, and battery voltage is obvious at a glance. Others are encouraged to build a duplicate unit and enjoy the hassle-free benefits it provides.

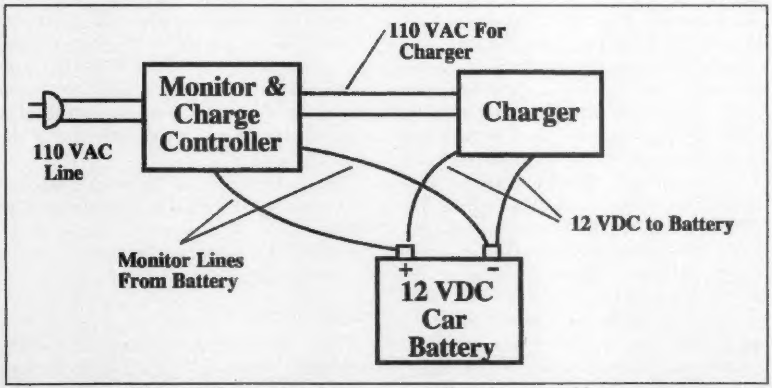


Figure 4. Connections between controller, charger and battery.

Parts List

Resistors	
1 each	270, 560, 820, 22k
2 each	10k, 27k
3 each	1.2k
1 each	Pot 1k, 10k
Capacitors	
1 each	0.1 @ 200V
1 each	2.2, 30 µF @25V
ICs	
1 each	LM3914, 4011B, MOC3010, RS276-1000
LEDs	
1 each	10-segment bar LED, mini LED

Misc. connectors, sockets, etc.

PCB available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 ($6.25 plus $1.50 S&H per order).

An Inexpensive Morse Code Keyer

Build your own for under 10 bucks.

by Tony Marchese N2YMW

A friend of mine recently convinced me to take the examination for an amateur radio license. I had previously considered obtaining a license but was less than thrilled with the prospect of learning Morse code. I argued that I was as dumb as a stump when it came to memorization but was assured that learning code was not as tough as it seemed.

I realized that the best way for me to learn Morse code was to actually generate the sounds. I perused the various amateur radio publications in search of a CW practice oscillator. I found several in the $30 range but, being a frugal individual (a.k.a. cheapskate), I opted to construct an oscillator of my own design based upon the following parameters:

1. Automatic formation of the dit/dah length relationship followed with a "space." The relationship between the dit, dah, and space, according to the *ARRL Handbook*, is defined in terms of unit length with a dah three times longer in duration than either the dit or space. A paddle set was used in place of a straight key to accommodate this feature.
2. Memory—holding one paddle "down" repeats the tone with the appropriate spacing inserted in between. Holding both paddles "down" alternates between dit and dah with a space inserted between tones.
3. Variable character speed to allow for advancement.
4. Total project cost of less than $10. All ICs and components were to be standard, readily available items, as I have rarely had luck locating those neat, obscure components that are used in some designs. Fortunately, I have a box (OK, several boxes) of recycled circuit boards and parts, to which my wife affectionately refers as "junk."
5. Long battery life to last through the countless hours of practice.
6. Adjustable sidetone oscillator.
7. The ability to connect the device to a transmitter.

Theory of Operation

I computed the acceptable frequency ranges for both the adjustable sidetone and character length oscillators as an initial design step. The oscillators were constructed using gates C, D, E, and F of U1, a CD4049 CMOS hex inverter with: Frequency = 1/(2.2 RC). The sidetone oscillator uses a resistance which varies from 6.8k ohm through 16.8k ohm, and a 0.047 µF capacitor to generate a frequency which adjusts from approximately 550 Hz to 1400 Hz. This accommodates the typical sidetone frequency range of 800 to 1200 Hz.

The unit length oscillator incorporates a resistance which varies from 3.3k ohm to 13.3k ohm, and a capacitance of 2.0 µF to create an adjustable 17 to 69 hertz oscillator. This oscillator provides the clock for U4, a CD4017 CMOS decade counter. The state of the U5 multiplexer A0 and A1 lines selects the main timing clock from either the 2, 4, 6, or 8 output of the decade counter, depending on whether a dit, dah, or space is under production. This configuration provides a consistent unit length relationship which is independent of frequency or oscillator drift. The use of the even outputs divides the clock by 2, resulting in a unit length frequency of 8.5 to 34.5 Hz. As the *ARRL Handbook* equates code speed, in words per minute (wpm), to the Frequency x 1.2, the oscillator produces a continuously variable 10-41 wpm character rate.

The "tone" cycle is initiated by depressing either the DIT or DAH paddle. Activating the DIT paddle places a high on the K input to the U3A flip-flop. The J input to the flip-flop is low, provided the DAH paddle is not also depressed. With the inhibit line to pin 6 of the U2B NOR gate low, the transition caused by depression of the DIT paddle clocks the U3A flip-flop, causing the Q output to toggle low. Since the J input of the U3B flip-flop is high and the K input is low, clocking the gate with the same pulse sets the Q output high, thereby temporarily inhibiting any further paddle clock pulses. The NOT Q output toggles low at this time, enabling the decade counter, the multiplexer, and the U6B BCD counter, which turns on the Q1 transmitter key transistor. The multiplexer's Y0x inputs now selected as A0 and A1 are both low. The DIT tone is created as the sidetone oscillator present on the multiplexer's Y0A input is passed through output ZA to the speaker.

After two unit length oscillator cycles, the equivalent of a DIT, the decade counter's Q2 output sets high. This high is gated through the multiplexer's ZB output, which clocks the U6A BCD counter, setting the Q0 output high. The Q0 output resets the U6B BCD counter to turn off the transmitter key transistor. The Q0 output also drives the multiplexer's input select line A0 high to now select the Y1x inputs. This silences the sidetone as Y1A is grounded and selects the decade counter's Q4 output as the new source for the U5A BCD counter enable clock. The decade counter's Q4 output requires two additional unit length oscillator cycles, the equivalent of a SPACE, before setting high to clock the U6A BCD counter. Clocking the U6A BCD counter sets the Q1 output high. This clears the U3B flip-flop to disable both the decade counter and the multiplexer while releasing the paddle clock inhibit line, pin 6 of U2B, and resetting the U6A BCD counter. The memory function utilizes the U2B NOR gate to generate a clock pulse and initiate a tone cycle if either paddle is depressed during the release of the paddle clock inhibit line. If both paddles are depressed, the U3A flip-flop Q output toggles states, thereby alternating between DIT and DAH tones. The keyer is now ready to generate the next tone.

The operation of the DAH paddle is similar, except the U3A flip-flop Q output toggles high. This selects the decade counter Q6 output, which requires three times as many clock cycles as the use of Q2, and in doing so sets up the appropriate DIT/DAH length relationship. The decade counter Q8 output functions as the SPACE interval, identical in operation to the use of Q4, described in the previous section.

The final stage of the circuit is comprised of transistor Q2 which, in conjunction with resistors R11, R12, and R13, forms an adjustable gain amplifier for control of the sidetone volume.

Construction

The complete circuit, illustrated in the schematic shown in Figure 1, uses six standard 4000-series CMOS ICs in the design.

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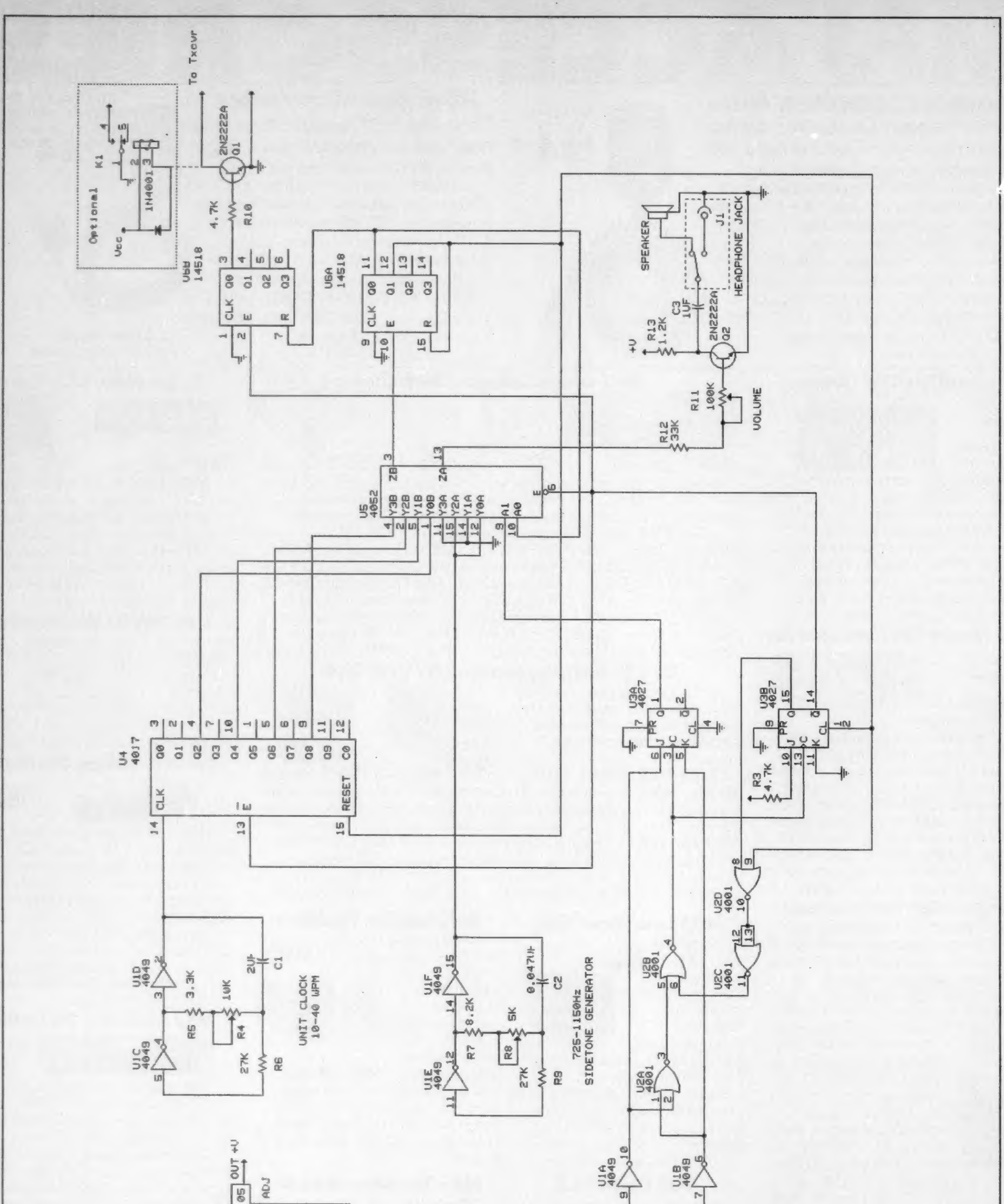

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Vcc
1N4001
K1
To Txcvr
2N2222A
Q1
4.7K
R10
U6B
14518
U6A
14518
CLK
E
R
Q0
Q1
Q2
Q3
SPEAKER
J1
HEADPHONE JACK
C3
1UF
+V
R13
1.2K
2N2222A
Q2
R11
100K
VOLUME
R12
33K
U5
4052
Y3B
Y2B
Y1B
Y0B
Y3A
Y2A
Y1A
Y0A
A1
A0
ZB
ZA
E
U4
4017
RESET
CO
U3A
4027
U3B
4027
PR
CL
J
C
K
R3
4.7K
U2D
4001
U2C
4001
U2B
4001
U2A
4001
U1A
4049
U1B
4049
U1C
4049
U1D
4049
U1E
4049
U1F
4049
R5
3.3K
10K
R4
27K
R6
2UF
C1
UNIT CLOCK
10-40 WPM
8.2K
R7
5K
R8
27K
R9
0.047UF
C2
725-1150Hz
SIDETONE GENERATOR
U7
78L05
IN
OUT +V
ADJ
POWER
9V BATTERY
+V
R1
4.7K
R2
4.7K
'DAH'
'DIT'

Figure 1. Keyer schematic.

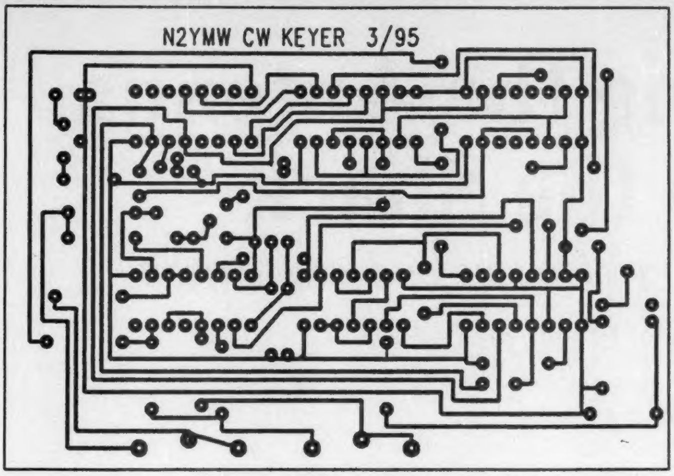

Figure 2. Printed circuit board artwork.

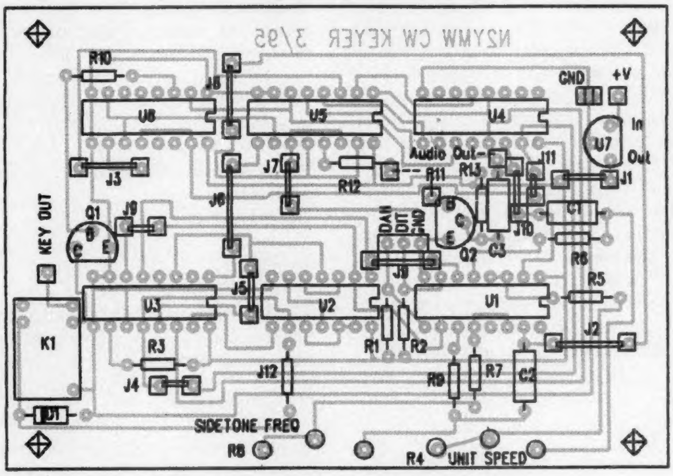

Figure 3. Printed circuit board parts layout.

Parts List

All of the required parts were obtained by mail order for less than $10.

U1	4049	Hex inverter/buffer
U2	4001	Quad two-input NOR gate
U3	4027	Dual JK, set/clear flip-flop
U4	4017	Decade counter
U5	4052	Dual four-channel analog multiplexer/demultiplexer
U6	14518	Dual BCD up counter
U7	78L05	5V regulator
J1-J11		Jumper wires
Q1	2N2222	NPN transistor
R1, R2, R3, R104.		7k resistor, 1/4 watt
R4, R8		10k potentiometer
R5		3.3k resistor, 1/4 watt
R6, R9		27k resistor, 1/4 watt
R7		6.8k resistor, 1/4 watt
R12		33k resistor, 1/4 watt
R13		1.2k resistor, 1/4 watt
C1		2.0 µF capacitor
C2		0.047 µF capacitor
C3		1.0 µF capacitor
K1		5V PC board relay—optional (Radio Shack 270-243 or equivalent)

1200 ohm piezo speaker
(Radio Shack 273-091 or equivalent)
SPST switch
9V battery connector
Metal case, approximately 5" x 3" x 2"
(Radio Shack 270-238 or equivalent)
Miscellaneous hardware

Parts Sources:
Mouser Electronics, several locations nationwide
(800) 346-6873

Radio Shack

A PC board is available for $5.50 plus $1.50 S&H from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

CMOS was chosen because this component series consumes minimal power, thereby prolonging battery life. I wire-wrapped the original design on a phenolic board which was then installed in a metal enclosure to minimize RFI. The printed circuit board shown in Figures 2 and 3 has since been developed to simplify construction. I was able to stuff and solder the circuit board in less than one hour.

I have been quite satisfied with the keyer's operation during my many hours of practice. I have not yet had a chance to connect the unit to a QRP transceiver but hope to do so by the end of the year. Please note: The 2N2222A NPN transmitter key transistor is used in an open collector configuration. The transistor will safely switch a maximum of 40 volts, which may be inadequate for some transmitters, especially the older, vacuum tube variety. Figure 1 details the optional relay circuitry which is required to switch the higher voltages typically found in older radios. Please check the transmitter's operating manual prior to connection of this unit. I hope you enjoy this project as much as I have.

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Measuring the Antenna from the Shack

The half-wavelength feedline and how to get it.

by Carroll R. Markivee WØRKU

Perhaps the two most common measurements that you can make on an antenna are its resonant frequency and its impedance at the place where the feedline is connected. Measuring the resonant frequency of the antenna is important in assuring that the antenna will efficiently radiate a signal; measuring the impedance is important in assuring that the feedline will transfer the signal to the antenna.

Making reliable contacts requires transferring maximum signal to the antenna, and radiating maximum signal from the antenna to other receivers. Unfortunately, most of us are in a hurry to get on the air so we cut the antenna to length with a tape measure, connect a piece of coax long enough to reach the shack, and begin to operate. Only after antenna erection do we realize that the SWR is not what we would like it to be. An antenna tuner or transmatch will not resonate the antenna nor improve the power transfer at the feed point to the antenna.

You can also prune the feedline, or lengthen it, to get a different SWR reading. This will not really change anything either. The SWR reading is most accurate when it is telling you the worst possible information it can tell you: the highest SWR reading it can give you. A low reading may be accurate, but it may also be way off base. If the SWR is very high, there will be maxima and minima all along the feedline. If the feedline length is such that your SWR bridge is at a minimum voltage point, the SWR bridge is not telling you how bad things are.

To maximize radiation from the antenna and power transfer to the antenna, we must resonate the antenna and improve the match of the feedline to the antenna.

There are many good instruments available. A dip meter or antenna bridge will give resonant frequency measurement. A noise bridge or a resistance and reactance bridge may be used for impedance measurements. Such measurements must be made at the feed point (see Reference 1) and, to get true readings, we can only make these measurements with the antenna at its operating position.

Making the Measurements

We cannot stand in the air at the feed point with the antenna at its operating height and make measurements. We must use a length of feedline that is an electrical half wavelength at the operating frequency. (Actually, this is even better than standing in the air at the feed point next to the antenna because it reduces body capacitance.)

The half-wavelength piece need not be heavy-duty cable. Any small cable, even twin lead, will do. If a half wavelength will not reach the antenna, use two or three half wavelengths or any integer number. However, replacing the feedline and making multiple measurements and adjustments can be tedious.

The standard method requires many steps:

1) Lower the antenna.
2) Replace the feedline with a half wavelength piece (or two, or three, etc.).

LOOP

3) Raise the antenna to regular operating height.
4) Measure the resistance, reactance, and resonant frequency. If the resistance is within 10% of the feedline impedance and the reactance is between +5 and -5 ohms (a good match), and the resonant frequency within 5%, you have good power transfer and radiation. Go to step 8.
5) Otherwise, lower the antenna again.
6) Adjust antenna length and/or matching section.
7) Go back to step 3.

END OF LOOP

8) Replace half-wavelength feedline with your regular feedline.
9) Raise the antenna.

My method replaces steps 1, 2, and 3 and reduces the loop with an incremental adjustment of the existing feedline. Incremental adjustment is a way to extend your existing feedline to a true half wavelength of feedline (or multiple), without lowering the antenna

CHART 1

TABLE OF LENGTHS OF COAXIAL CABLE YOU CAN USE FOR INCREMENTS OF A WAVELENGTH AT EACH AMATEUR BAND.

FREQUENCY	.01	.02	.04	.08	.16	.32
28.3 MHZ	0' 2.75"	0' 5.5"	0' 11"	1' 10"	3' 8"	7'4"
24.96MHZ	0' 3.1"	0' 6.25"	1' .50"	3' 0"	4' 2"	8' 4"
21.2MHZ	0' 3.6"	0' 7.5"	1' 2.7"	2' 5.4"	4' 10.9"	9' 10"
18.13MHZ	0' 4.3"	0' 8.6"	1' 5.2"	2' 10.4"	5' 8.8"	11' 5"
14.3MHZ	0' 5.4"	0' 10.8"	1' 9.8"	3' 7.6"	7' 3.25"	14' 6.5"
10.12MHZ	0' 7.7"	1' 3.4"	2' 6.8"	5' 1.6"	10' 3.25"	20' 6.5"
7.2MHZ	0' 10.8"	1' 9.6"	3' 7.3"	7' 2.6"	14' 5.3"	28' 10"
3.75MHZ	1' 9"	3' 5.5"	6' 11"	13' 10.6"	27' 8.7"	55' 7"
1.875MHZ	3' 5.5"	7' .2"	14' .5"	28' 1"	56' 2.5"	112' 5"
OTHER PRACTICAL UNITS WHICH MAY BE USED						
ENGLISH UNITS						
(18 - 28MHz.)	3"	6"	1'	2'	4'	8'
(7 - 14 MHz.)	9"	1.25'	2.5'	5'	10'	20'
(1.8- 4 MHz.)	2'	4'	8'	16'	32'	64'
METRIC UNITS						
(18 - 28MHz.)	12.5 CM.	25 CM.	50 CM.	1 METER	2 METERS	4 METERS
(7 - 14 MHz.)	37 CM.	75 CM.	1.5 METERS	3 METERS	6 METERS	12 METERS
(1.8- 4 MHz.)	1 METER	2 METERS	4 METERS	8 METERS	16 METERS	32 METERS

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or replacing the feedline. It requires a little patience and some time, but very little expense.

This method requires five or six pieces of coax, each with an inexpensive slide-on coax connector. These are easy to put together. They should have a binary relationship in length, such as 1, 2, 4, 8, 16, or possibly 32. Make up combinations of pieces to convert your existing feedline to a true half wavelength for the time you are measuring it, and remove the pieces when you want to operate. (You still have to lower the antenna once to make the final adjustment.)

You can use any scale you want for finding the sizes of the pieces of coax. I wanted to find the resonant frequency at 3.750 MHz, so I calculated the sizes for 0.01, 0.02, 0.04, 0.08, and 0.16 wavelength at that frequency. Later I added 0.32 wavelength. Chart 1 shows both the actual sizes I used and the corresponding sizes for other frequencies. They are called increments because each small piece (a fraction or increment of a wavelength) can be added to other small pieces to reach a half wavelength.

Instead of fractions of a wavelength, you can "scale" the pieces of coax according to inches or centimeters; these are included in the table. Any scale will work, as long as it is small enough and you have enough pieces. Chart 1 gives a number of examples of lengths that may be useful, and indicates that other measurements may be used. The increments are to be added to your existing feedline as explained below.

To use these pieces of coax:

1) Assemble them into every possible combination of lengths, as shown in Chart 2.
2) Try each combination, adding it to the shack end of the existing feedline.
3) Use your noise bridge or resistance bridge and impedance bridge to determine resistance and reactance at that combination. Write down your readings.
4) Plot these points on graphs.

My antenna was long for the 80 meter band, and I wanted to adjust it to resonate at 3.750 MHz. At the flat portion of the curve on my graphs there is an equivalent half wavelength of the feedline. This is halfway between the peaks of the one-quarter and three-quarter wavelengths. That shows the ideal increment, the amount of added feedline that makes a half wavelength equivalent out of your existing feedline, without lowering the antenna! With that added length in place, you can measure the real resistance, reactance, and resonance.

CHART 2 COMBINATIONS OF INCREMENT UNITS
INCREMENT OF A WAVELENGTH AT EACH BAND

MEASUREMENT NUMBER	.01	.02	.04	.08	.16	.32
1	X					
2		X				
3	X	X				
4			X			
5	X		X			
6		X	X			
7	X	X	X			
8				X		
9	X			X		
10		X		X		
11	X	X		X		
12			X	X		
13	X		X	X		
14		X	X	X		
15	X	X	X	X		
16					X	
17	X				X	
18		X			X	
19	X	X			X	
20			X		X	
21	X		X		X	
22		X	X		X	
23	X	X	X		X	
24				X	X	
25	X			X	X	
26		X		X	X	
27	X	X		X	X	
28			X	X	X	
29	X		X	X	X	
30		X	X	X	X	
31	X	X	X	X	X	
32						X
...						
40				X		X
...						
50		X			X	X
...						
63	X	X	X	X	X	X

The above combinations are assembled and connected (in series).

In my case, the half wavelength was reached by adding 0.34 wavelength. The resonant frequency was 3.025 MHz, and the resistance was 21 ohms with a reactance of +1 ohm. The SWR was 2.5:1 at this point, but the SWR wandered all over the place as the feedline length was changed! The only accurate SWR reading was the one at the half wavelength point. If I had chosen to, I could have made the antenna and feed point match look pretty good by adding 0.45 wavelength of feedline permanently to make the SWR read 1.6:1! But I would only be fooling myself.

The resonant frequency of 3.025 MHz

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called for a reduction to 81% of the original length to get to 3.750 MHz (3.025/3.750). I lowered the antenna one time, cut it 19%, and raised it back up. It resonated at 3.740 MHz; the resistance was 48 ohms and the reactance was +1 ohm. The SWR was 1.1:1. That was close enough for me, so I stopped right there.

I removed the extra feedline, and operated with the assurance that I was transferring maximum power to the antenna, and radiating maximum signal. My signal strength reports are up about 10 dB. Best of all, I know that my antenna is operating at peak efficiency!

References:

1. *ARRL Antenna Book,* 16th Edition, 1991, pp. 2-6.
2. *Antenna Impedance Matching,* Wilfred N. Caron, 1989, pp. 2-9.

Velocity Factor

The equation I used for calculating the feedline lengths, including the velocity factor (coaxial cable propagation factor), was: Feet = (486/MHz) x VF x N/50, where VF = velocity factor and N = number of hundredths of a wavelength you want. For example, for 0.02 wavelengths, N = 2; for 0.04 wavelengths, N = 4. The velocity factor I used was 0.70, determined by measurement.

The standard reference tables (from the *ARRL Antenna Book,* 16th Edition, pp. 24-19) of characteristics of transmission lines indicate the following values for the velocity factor in common transmission lines:

Transmission Line	Velocity Factor
RG-8X	0.75
RG-8	0.66
RG-8 Foam	0.80
Belden 9913	0.84
Belden 9914	0.78

I determined the velocity factor of my length of coax with a noise bridge and a general-coverage receiver. I used the simple formula: VF = Lf/984 x N, where VF = velocity factor, L = line length in feet, f = frequency in MHz., and N = number of electrical wavelengths in the line.

To use this formula, select a piece of the coaxial cable you are going to use. It should be equal to, or slightly longer than, either one-quarter wavelength or one-half wavelength for the frequency of greatest interest. Attach a PL-259 coax connector to one end. If it is about one-quarter wavelength long, leave the other end open; if it is one-half wavelength long, then short circuit the other end. Attach it to the noise bridge. Set the noise bridge to zero resistance and zero reactance (R = 0 and X = 0). Tune the receiver for a null in the noise bridge signal, and you have found the frequency (f) to plug into the formula above. N will be either 0.25 or 0.50, according to whether you chose a quarter or a half wavelength. Determine L with a good tape measure.

My calculations showed the VF of the RG-8X I was using to be 0.70, rather than the 0.75 shown in the table. This was probably taking into account the connector used and other unknown factors.

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73 Review

Number 11 on your Feedback card

by Peter H. Putman KT2B

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Price Class: $64.95 (MSRP)

The COY2M3EL "Stealth" VHF Yagi

A 144 MHz antenna from Swiech Communications Systems.

While doing some cleanup this past spring in my amateur radio "barn" (a small shed in my back yard full of masting, antennas and coax), I came across an old, beat-up, bent, dented and otherwise trashable KLM four-element 2 meter yagi. I've owned this particular antenna for about 14 years and it has really been through the ringer, accompanying me on over a dozen mountaintopping trips, more than a few Field Days, and several public service events.

It got me to wondering if anyone made a really durable yet portable yagi for yeoman 2 meter service—as a temporary link antenna—for Field Day use or the odd mountaintop trip. This "ideal" antenna would have to be fairly lightweight yet very durable and take a minimal amount of time to assemble in the field. "Dream on," I thought ... until I made the rounds at Dayton last year!

The COY2M3EL "Stealth"

This nifty three-element 2 meter beam caught my eye the minute I walked past the Swiech Antennas booth: It's jet black with steel hardware and nickel-plated connectors and really resembles something from the Air Force's "stealth" technology program. The boom is round like most conventional yagis, and the elements mount to the boom with a composition block that attaches with a single bolt and wingnut. Black end caps and protective tips on the 1/4"-thick elements finish off the professional appearance.

The "Stealth" measures 38"—quite a bit shorter than most small 2 meter yagis I've ever used, but also heavier by at least a pound. Indeed, the "Stealth" is a very substantial antenna and I have no doubt of its ability to survive severe weather in a permanent installation. However, the slight increase in weight does make a difference when you lug it around for some time in a portable application, so Gene Swiech WB9COY recommends this antenna (and its 440 MHz companion, not reviewed) for temporary and permanent point-to-point link operations.

Assembly of the COY2M3L is very simple—you just slide each element and its mounting block onto the boom, center them over the mounting holds, and insert a stainless #8 screw and wingnut to fasten it. Gene also intended for the COY2M3L to be carried in a standard nylon zipper bag, hence the protected element ends and boom caps. The boom-to-mast clamp fastens directly through the boom with a single U-clamp, and you can opt for either vertical or horizontal operation.

Performance

Swiech claims 6.1 dBd (over a dipole) gain for the yagi, and while I couldn't accurately verify this number I did take a look at the pattern and VSWR using a simple test range with a 2 meter source and whip antenna several wavelengths distant. At 45 degrees either side of the test signal, it was reduced by 2.5 dB while at 90 degrees, the signal was down by 16.5 dB, and the front-to-back ratio clocked in at 10 dB—adequate for foxhunting or link work.

The feed is a gamma match design, which usually results in a narrowband match with corresponding hi-Q response. I swept the antenna from 140 MHz to 150 MHz, showing 2:1

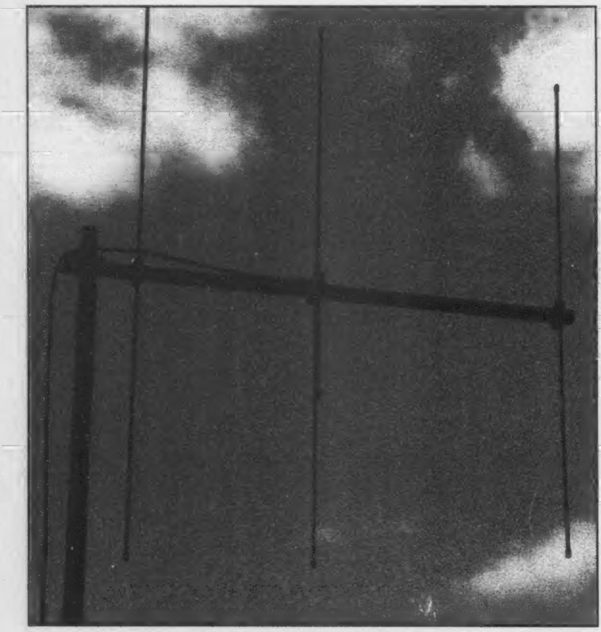

Photo A. The Swiech COY2M3EL yagi.

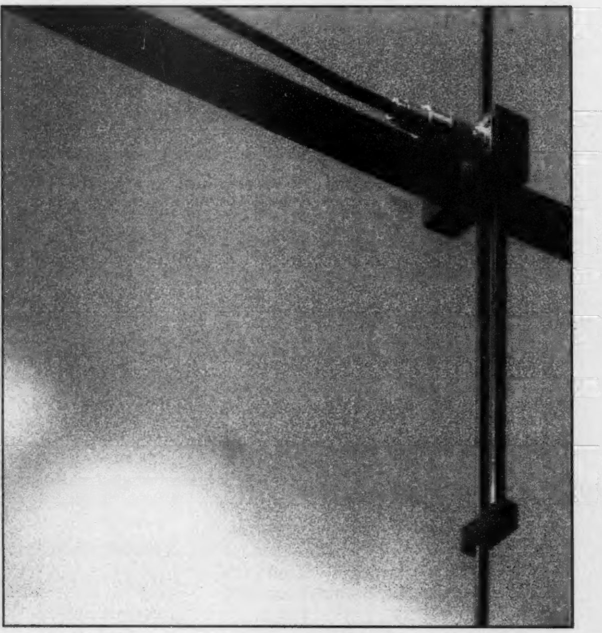

Photo B. Close-up of the gamma match element mounting block.

SWR at 143 and 149.5 MHz. At 144 MHz, it dropped to 1.4:1 and at 146 MHz the Bird 43 showed less than 1.05:1. VSWR does not increase appreciably until about 149 MHz—at 148 MHz, it was less than 1.25:1. In general, the COY2M3L showed very good response across the entire band.

In Actual Use

I loaned the COY2M3EL out to a local club for a foxhunt this past summer, along with a couple of step attenuator boxes and a small mast. The consensus was (A) It's a bit heavy for holding in your arm over any length of time, and (B) who cares?—it's the sharpest-looking antenna in the crowd! The pattern was adequate for DFing with the step attenuators, so perhaps a mobile installation would be more appropriate when on a hunt.

The acid test: Would it survive one of my long hikes up a mountain loaded down with radios, batteries and masting (especially when I'd "whack" into a rock or tree on the narrow trail)? Well, the COY2M3EL came through looking a lot better than the rest of my antennas. Although I prefer square boom material to make element alignment easier, I will say that a strong round boom generally holds up better in the long run. Not only that, but the COY2M3EL's compact size took up less room in my pack.

As far as contest performance goes—well, how much can you expect from a short three-element yagi? The COY2M3EL was just perfect for making dozens of 2 meter FM contacts, while I relied on my nine-element Tonna for the long-haul SSB and CW work. No doubt about it, the COY2M3EL is far better suited for general-purpose temporary and emergency portable and fixed use than in contest operation, but I bet it will look and work just as good 10 years after you buy it. How many antennas can make that claim?

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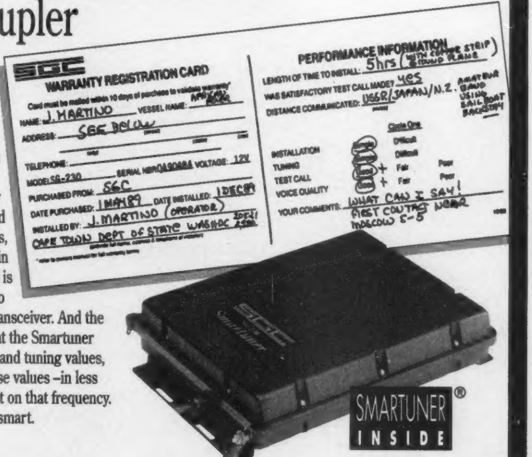

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ADDRESS: SEE BELOW
TELEPHONE:
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PURCHASED FROM: SGC
DATE PURCHASED: 1 MAR 89 DATE INSTALLED: 1 DEC 89
INSTALLED BY: J. MARTINO (OPERATOR)
CAPE TOWN DEPT OF STATE WASH DC [illegible]

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LENGTH OF TIME TO INSTALL: 5hrs (WITH COPPER STRIP GROUND PLANE)
WAS SATISFACTORY TEST CALL MADE? YES
DISTANCE COMMUNICATED: USSR/JAPAN/N.Z. AMATEUR BAND USING SAILBOAT BACKSTAY
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TUNING
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Tone Burst Generator and Decoder

Versatility and control for under $5.

by Klaus Spies WB9YBM

In the United Kingdom, tone bursts have been used for many years to key up repeaters. This is not only an alternative to PL—if it's used in addition to PL, many more functions in remote bases or repeaters can be accessed remotely.

When initially investigating tone bursts, I was shocked at the price of commercially available units, considering the simple function. I grabbed for my junk box as quickly as I threw out my stack of catalogs!

Of the wealth of ICs available that generate tones, I decided on using the 555, because it is commonly available and easy to work with. Half of a 4538 (a resettable retriggerable one-shot) is used to trigger the 555 for a predetermined period of time, calculated by T = RC. Half will also be used in the decoder. With only six ICs, the whole circuit won't take up much room in a standard-size transceiver, or on a ham shack bench (if left external in its own box).

The 567 decoder/PLL has been used for many years as a DTMF tone decoder, making it a time-proven device. U1B, with the help of U5, makes sure the tone is decoded for the proper length of time before giving a valid output, eliminating falsing.

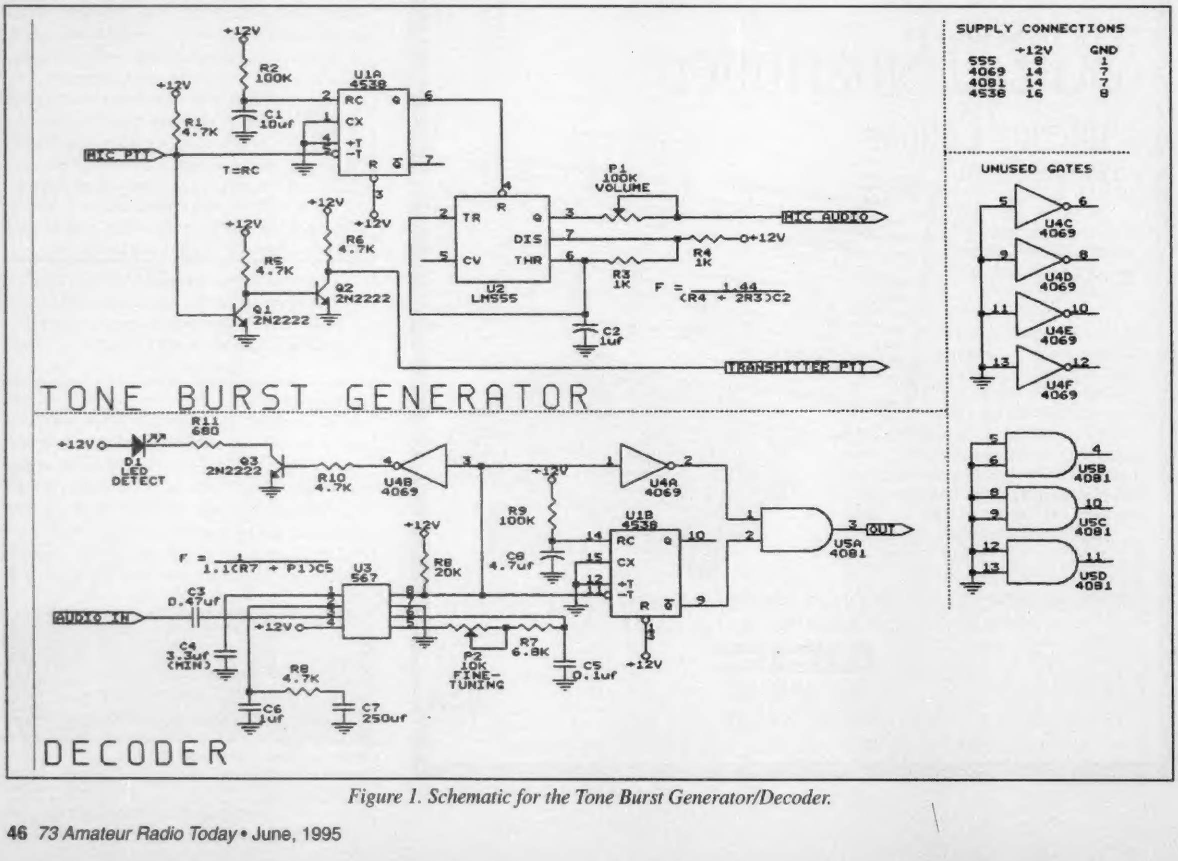
Final Assemby

If used as an external accessory to your transceiver, this circuit should be enclosed in a metal box connected to the ground of the power supply, for proper shielding. A shielded audio cable is also highly recommended for all audio lines.

Whether it's used as a stand-alone or built-in accessory for your transceiver, unused gates should be grounded as shown. RF bypass capacitors should be used on all input and output leads, and depending on the levels of RF in your shack (both from your own equipment and any local commercial broadcasters), choke coils and/or ferrite beads are definitely a good idea.

The entire circuit can be built for less than five dollars—a definite savings over commercially built units!

Continued on page 48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+12V
R1 4.7K
R2 100K
C1 10uf
U1A 4538
RC
CX
+T
-T
R
Q
Q̄
MIC PTT
T=RC
R5 4.7K
R6 4.7K
Q1 2N2222
Q2 2N2222
U2 LM555
TR
R
CV
DIS
THR
P1 100K VOLUME
MIC AUDIO
R4 1K
R3 1K
C2 1uf
F = 1.44 / (R4 + 2R3)C2
TRANSMITTER PTT
DECODER
D1 LED DETECT
R11 680
Q3 2N2222
R10 4.7K
U4B 4069
U4A 4069
R9 100K
C8 4.7uf
U1B 4538
U5A 4081
OUT
F = 1 / 1.1(R7 + P1)C5
U3 567
R8 20K
C3 0.47uf
AUDIO IN
C4 3.3uf (MIN)
R8 4.7K
C6 1uf
C7 250uf
P2 10K FINE-TUNING
R7 6.8K
C5 0.1uf
UNUSED GATES
U4C 4069
U4D 4069
U4E 4069
U4F 4069
U5B 4081
U5C 4081
U5D 4081

SUPPLY CONNECTIONS

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555	8	1
4069	14	7
4081	14	7
4538	16	8

Figure 1. Schematic for the Tone Burst Generator/Decoder.

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Item	Quantity	Reference	Part
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2	2	C2,C6	1 µF
3	1	C3	0.47 µF
4	1	C4	3.3 µF
5	1	C5	0.1 µF
6	1	C7	250 µF
7	1	C8	4.7 µF
8	1	D1	LED
9	3	P1,R2,R9	100k
10	1	P2	10k
11	3	Q1,Q2,Q3	2N2222
12	5	R1,R5,R6,R8,R10	4.7k
13	2	R3,R4	1k
14	1	R7	6.8k
15	1	R8	20k
16	1	R11	680
17	1	U1	4538
18	1	U2	LM555
19	1	U3	567
20	1	U4	4069
21	1	U5	4081

Parts Sources:

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Tri-State Electronics, (708) 255-0600

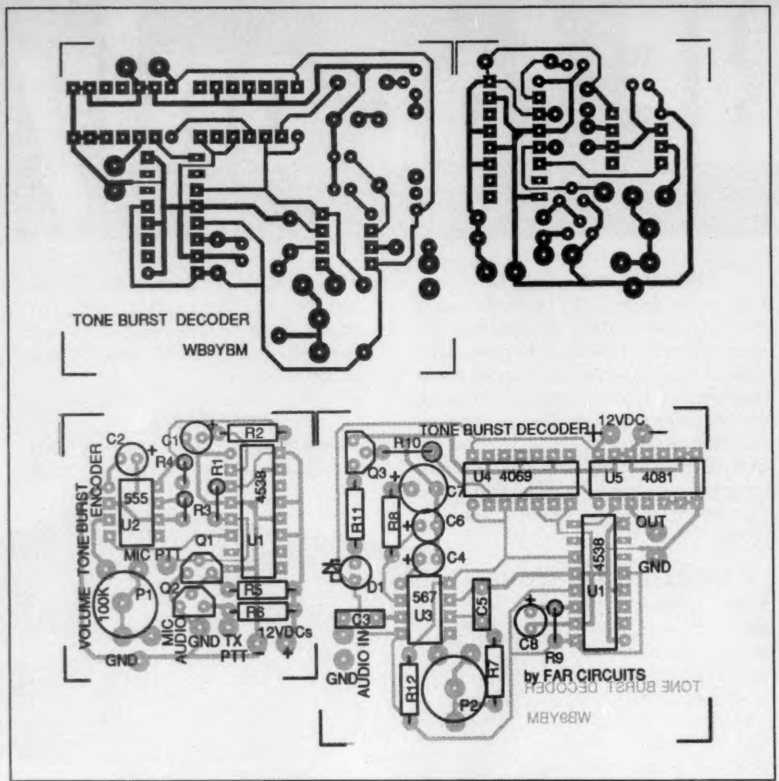

Figure 2. (right) Drilled and etched PC boards are available for $6.00 plus $1.50 S & H per order from Far Circuits, 18N640 Field Court, Dundee, Il 60118.

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Use coax feed, random wire or balanced lines. Has oversized *heavy duty* 4:1 balun.

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Pre-tuning into a dummy load makes tuning your actual antenna faster and easier.

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You'll find it handy for tuning, testing and repairing your rig, setting power level, adjusting your mic gain and more.

Watchout for cheap midget size dummy loads that changes resistance as it heats up -- marginal ones could burn up your transceiver.

Custom Inductor Switch

The inductor switch is the most likely component to burn up in *any* antenna tuner.

The inductor switch in the MFJ-949E was *custom* designed to withstand the extremely high RF voltages and currents that are developed in your tuner -- it's not a flimsy *plastic* switch made for small signals and wired with *tiny* gauge wire.

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Each MFJ-949E cabinet is chemically treated and has a new tough scratch-proof *vinyl* cladding -- not paint that can scratch or chip off. You won't find a tougher, longer lasting finish anywhere.

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Parametric Amplifiers (Huh?!?)

The *parametric amplifier* (see Figure 1) is capable of high gain and low noise operation in the UHF and microwave regions, but is fundamentally different from conventional forms of amplifier. The parametric amplifier takes its name from the fact that amplification occurs through exciting a circuit parameter. This amplifier is actually misnamed because it is the reactance parameters (X_C and X_L) that are excited. Perhaps a better name is *reactance amplifier.*

A reactance differs from a resistance in that the latter dissipates power, while reactances store energy and redeliver it to the circuit without any power dissipation. If the reactance can be varied at a rapid rate, then the energy stored and discharged by the reactance can be used to amplify the signal. Although either capacitors or inductors can be used in parametric amplifiers, it is the capacitive reactance that is used in practical circuits because suitable voltage variable capacitance diodes ("varactors") are easily available.

In a varactor, the capacitance is a function of the reverse bias potential applied across the PN junction of the diode. A typical varactor useful in parametric amplifiers has a breakdown voltage of -4 to -12 volts, and a zero-bias junction capacitance of 0.2 to 5 picofarads. The cutoff frequency should be high with respect to the operating frequency. Generally, the noise figure is improved with higher diode cutoff frequencies.

The low noise figure of the parametric amplifier derives from its use of a reactance as the active element. In an ideal circuit, the noise generated is zero. In real circuits, however, there are resistive losses associated with the tank circuit and the varactor, and these give rise to thermal agitation ("Johnson") noise. In addition, other processes take place inside the diode to generate noise. As a result, parametric amplifiers exhibit low noise factors, but not zero.

Parametric amplifiers can be operated in either of three modes: *degenerative, non-degenerative,* or *regenerative.* We will consider both modes, and provide a tool for evaluating parametric amplifier circuits.

Degenerative Parametric Amplifiers

Figure 1A shows the basic parametric amplifier. The varactor diode is connected so as to switch the signal on and off to the load as an external "pump" signal is applied. Although shown here as a series connected switch, both series and parallel connected diodes are used. The signal and pump waveforms (see Figure 1B) are phased such that the diode capacitance is fully charged when the peak of the pump signal arrives. The charge is constant so, using the formula V = Q/C, the voltage must increase as the pump voltage drives the diode capacitance down.

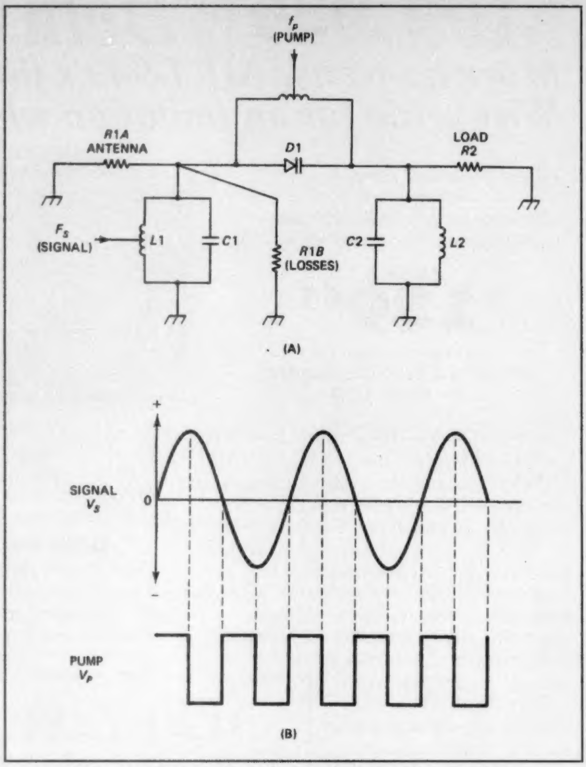


Figure 1. a) Parametric amplifier circuit. b) Operating waveforms.

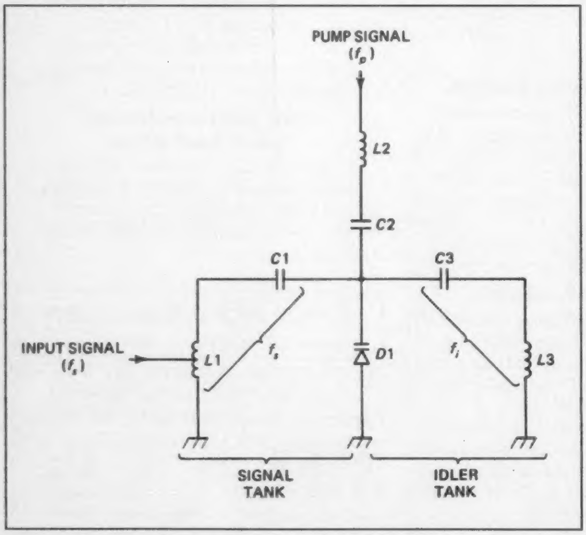


Figure 2. Parametric amplifier cirucit.

Parametric amplification occurs when the peak of the pump signal coincides with both positive and negative peaks of the signal waveform. Increasing the pump potential (as at the peak) drives the diode capacitance to minimum, and it is at this time that capacitor charge is dumped to the load. To achieve degenerative parametric amplification, the phasing must be precise, and this requirement means that the pump frequency must be the second harmonic of the signal frequency.

A severe limitation to the degenerative parametric amplifier is the necessity of precisely phasing the pump and signal waveforms. Drift in either signal can reduce the gain or prevent the circuit from operating. A broader bandwidth method is to use the non-degenerative or regenerative parametric amplifier circuits.

Non-Degenerative and Regenerative Parametric Amplifiers

The requirement for precise phasing in the degenerative parametric amplifier is relieved somewhat in the non-degenerative case (Figure 2) by the presence of a third frequency. In addition to the signal frequency (f_s) and the pump frequency (f_p), we now also have an *idler frequency* (f_i). In Figure 2 note that the third resonant tank circuit (L3C3) is tuned to f_i. The idler fre-

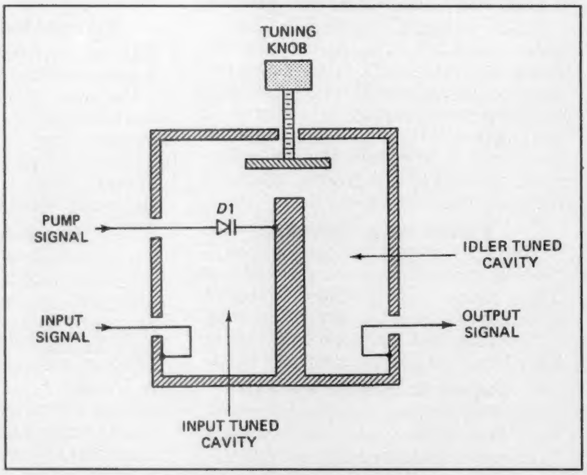


Figure 3. Microwave parametric amplifier.

quency is the output frequency of the circuit which, incidentally, also operates as a frequency translator or converter.

There are two general cases of non-degenerative parametric amplifiers: *up-converters* and *down-converters*. In the up-converter case the idler frequency is the sum of the pump and signal frequencies:

$$F_i = F_s + F_p$$

In the down-converter case, the idler frequency is the difference between pump and signal frequencies:

$$F_i = F_s - F_p$$

Power gain is defined as the ratio of the output power to the input power. In the case of a lossless circuit, the gain of the up-converter (f_i greater than f_s) is:

$$G = \frac{F_i}{F_s}$$

The down-converter case is actually a loss (attenuation), rather than a power gain.

The third category of parametric amplifier is the regenerative circuit, and is actually a special case of the non-degenerative amplifier. In the regenerative amplifier the pump frequency is the sum of the signal and idler frequencies. In this case power gain is negative, which implies a negative resistance characteristic. As a result, the circuit is regenerative. Implicit in this property, if the circuit can be kept out of oscillation, is very low noise coupled with very high gain.

Noise in Parametric Amplifiers

The low noise capability of the parametric amplifier is a result of the fact that the amplifier element is a reactor rather than a "resistor." In an ideal parametric amplifier the noise figure is zero, but in practical circuits we have two noise contributors: *circuit losses* and *frequency conversion noise*. These sources combine to create a non-zero noise factor of the order:

$$F_n = \frac{R_a}{R1} + \frac{F_s}{F_i}$$

Where:

F_n is the noise factor
R_a is the antenna impedance resistive component
R1 is the sum of circuit resistive losses
f_i is the idler frequency
f_s is the signal frequency

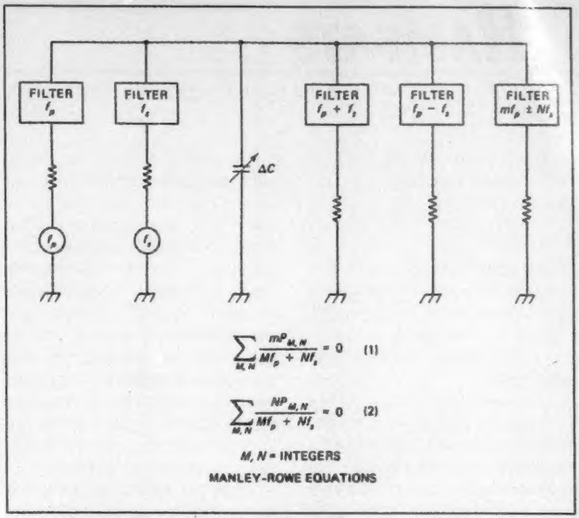
Some authorities recommend a pump frequency seven to 10 times the signal frequency for lowest noise operation.

Microwave Configuration for Parametric Amplifiers

The circuit examples presented thus far show inductor-capacitor (LC) resonant tank circuits for the various frequencies. These circuits work well in the UHF and lower microwave region. At higher microwave frequencies, however, the LC tank circuit fails to work well and is not practical. Therefore, we see parametric amplifiers with resonant cavities (Figure 3) in place of resonant tank circuicts. A tuning disk tunes the cavities to resonance.

The Manley-Rowe Relationships

In 1957 Manley and Rowe proposed a means for evaluating parametric amplifier circuits. Consider the equivalent circuit in Figure 4. In this circuit we have a variable capacitance as the reactor element and two signal sources: the signal frequency (f_s) and the pump frequency (f_p), both of which are shown as generators. In series with both generators are filters that pass the generator frequency and totally reject all other frequencies. There is also a series of loads, each of which is isolated from the others by the same kind of ideal narrowband filter. The frequencies of these filters are: ($f_p + f_s$), ($f_p - f_s$), up to ($mf_p \pm nf_s$) (where M and N are integers). The Manley-Rowe relationships are shown at the bottom of Figure 4.



$$\sum_{M,N} \frac{mP_{M,N}}{Mf_p + Nf_s} = 0 \quad (1)$$

$$\sum_{M,N} \frac{NP_{M,N}}{Mf_p + Nf_s} = 0 \quad (2)$$

M, N = INTEGERS

MANLEY-ROWE EQUATIONS

Figure 4. Equivalent circuit for Manley-Rowe relationship analysis.

In working with Manley-Rowe equations we recognize the following algebraic sign conventions regarding power:

1. +P is assigned to power flowing either into the capacitor, or from the pump and input signal "generators," and

2. -P is assigned to power flowing out of the capacitor or into a load resistance.

Stability of the parametric amplifier is determined by the sign of the power flowing with respect to the capacitor. If the power from the signal flows into the capacitor, then the stage is stable. Because we deal with integers from 0 through the *ith*, we can check not only the fundamental frequencies (m and n are 1), but also their respective harmonics (m,n are integers greater than 1). Some of these combinations are stable, while others are unstable.

Parametric amplifiers are a bit exotic, but were once quite popular with the microwave and upper UHF crowd. If you want to research this matter, see older issues of the various ham magazines, especially those with a technical slant. ■

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A Fiery End

UNAMSAT-1 from Mexico and TECHSAT-1 from Israel were scheduled for launch on March 28th from the Plesetsk facility in Russia. The end result was not new hamsats in orbit.

Last month's column provided details on the capabilities of the two amateur satellites. UNAMSAT-1 was a microsat-class satellite to be used for digital store-and-forward activities and meteor-scatter studies. TECHSAT-1 was to also provide digital message operations, in addition to carrying a new imaging experiment providing precompressed picture files on the digital downlink frequency.

Reports from Russia just after the launch attempt were sketchy. Many conflicting accounts were heard and passed through amateur-radio channels. Some reports stated that the satellites had achieved orbit, while others described a watery end due to a failed fifth stage. Unfortunately, the latter story held the most truth.

Two weeks prior to launch a video report was given from Plesetsk through the Moscow Ostankino Television First Channel Network. Reporters Yan Borlin and Sergei Telov described the event as a civilian venture involving three satellites to be sent into orbit by a strategic SS-25 (TOPOL) missile. The rocket for the project was built by the Moscow Heat Technology Institute, the organization that originally designed the military TOPOL. The reporters went on to explain that the experimental launches are designed to demonstrate the possibility of large-scale conversion of the strategic missiles for commercial use. Otherwise, the SS-25s would end up as scrap within a few years due to treaty terms specifying arms reductions.

David Liberman XE1TU, Project Manager for UNAMSAT-1, went to Plesetsk with students from the Autonomous University of Mexico (UNAM). David reported that the integration of the Mexican microsat went perfectly. Removal from the packing box to installation and test on the rocket took only 35 minutes. The Russian mechanical satellite model (non-operational payload) and TECHSAT-1 were also attached without problems.

David and the rest of the participants and observers were ready for launch just after noon on March 28th. They watched the attempt from a location five kilometers from the mobile launcher system. The SS-25 started from a horizontal position. In less than 15 seconds it was hydraulically lifted to vertical. David said that two seconds later the first stage ignited and there was no turning back. A local PA system gave updates on altitude for the launcher that was rapidly disappearing into the cold Russian sky.

When the announcer got to the fourth-stage progress, the reports stopped. No explanation was immediately given. The group was eventually told that telemetry from the rocket had quit.

At the banquet that evening few were eating and the mood was somber. Just before midnight David boarded the train for Moscow. The 18-hour trip seemed to last forever. Back at the Moscow University ham shack nothing had been heard from either UNAMSAT-1 or TECHSAT-1. The loss of telemetry from the rocket was not a simple fault. A failure had occurred and the satellites never made it to orbit.

Later reports continued with some confusion. Some said the fifth stage failed, while others blamed the fourth-stage engine. Careful study of the events shows that the fourth stage probably ignited early. This caused the rocket to explode somewhere over the Ural mountains. The would-be hamsats came back to earth, impacting on land, far downrange from the launch site.

The Next Step

David and the UNAM students have decided to prepare their second set of microsat satellite modules for flight. Two sets were made. While the best set met a fiery end, the others are functional and can be checked, aligned, calibrated, tested and readied. The only expensive items missing are solar panels. Work has begun to acquire more for UNAMSAT-2.

Negotiations have begun to allocate another launch. XE1TU and the UNAMSAT crew will continue to provide updates on progress toward the next step. The TECHSAT team in Haifa is also reported to be working toward at least one replacement for their ill-fated spacecraft.

AMSAT President Bill Tynan W3XO posted a message expressing the feelings of hamsat chasers everywhere, "Speaking for all of the Amateur Radio Space enthusiasts around the world, I extend to both the UNAMSAT and TECHSAT teams our sympathy over their losses. It goes without saying that everyone is heartened by the resolve of both groups to rebuild and try again."

More Signals From Space

Astronaut/Cosmonaut Norm Thagard has been flying high aboard the *Mir* space station operating as R0MIR. He has made many voice contacts with hams around the world. In June, STS-71 will arrive at *Mir* to drop off some passengers and pick up Norm for the ride home. Until then he will continue to make QSOs using FM on 145.55 MHz simplex.

> ***"In order to alleviate confusion and interference with the* Mir *ham operations, STS-71 will use a different set of ham frequencies."***

The *Mir* rendezvous mission of STS-71 will also feature SAREX, the Shuttle Amateur Radio EXperiment, with a new twist—no SAREX gear will be aboard. A Motorola radio on the flight used for communications with *Mir* is also capable of operation in the 2 meter ham band and will be used for that purpose when available.

Usually SAREX operations use a downlink of 145.55 MHz. In order to alleviate confusion and interference with the *Mir* ham operations, STS-71 will use a different set of ham frequencies. The global downlink for STS-71 will be 145.84 MHz, while uplinks will be on 144.45 and 144.47 MHz. Since STS-71 has none of the usual SAREX equipment, there will be no packet operation, only voice. Be careful to transmit exclusively when activity is heard on 145.84 from the shuttle.

To make matters more interesting, the current shuttle schedule has STS-70 set for launch just days before STS-71. STS-70 is also a SAREX mission, but with the usual SAREX gear. This means that the customary SAREX frequency plan will be in effect for STS-70. As a reminder, normal SAREX operation uses a 145.55 MHz downlink. For voice, the uplinks are 144.91, 144.93, 144.95, 144.97 and 144.99 MHz over North America. When the packet system is on, the uplink is 144.49 MHz. Although schedule changes will likely move launch dates for STS-70 and STS-71 a bit, early June promises some exciting ham-in-space adventures on 2 meters.

Field Day 1995

Field Day is once again just around the corner on June 24th and 25th, and AMSAT is proud to announce the 1995 AMSAT Field Day competition. Last year's effort was very successful. The competition is to encourage the use of all amateur satellites, both analog and digital.

Here are the rules for the 1995 AMSAT Field Day competition.

Analog Transponders

Each satellite transponder is considered a separate band. This means that AMSAT-OSCAR-13 Mode "S" is separate from A-O-13 Mode "B."

All phone QSOs and all CW QSOs on a given satellite transponder are considered separate bands. This means that A-O-13 Mode "S" CW is separate from A-O-13 Mode "S" phone.

Therefore, for reporting purposes, A-O-13 has four possible "bands" including Mode "B" CW, Mode "B" phone, Mode "S" CW and Mode "S" phone.

All packet/RTTY/ASCII/AMTOR QSOs through analog transponders are counted as CW QSOs.

Phone QSOs count for one point and CW QSOs count for two points. Cross-mode (CW-phone) contacts are not allowed.

The use of more than one transmitter at the same time on a single satellite transponder is prohibited. This means that two stations at the same Field Day site can operate through A-O-13 at the same time, but only if one is operating Mode "S" and the other Mode "B." If two stations at a given site are set up for Mode "B" operation, only one can be on A-O-13 (CW or phone). The other station can be used for different hamsats (like A-O-10), or for other Field Day activities.

Digital Transponders

For the pacsats (L-O-19, K-O-23, etc.), each satellite is considered a separate band.

Do not post "CQ" messages. Simply upload *one* greeting message to each satellite and download as many greeting messages as possible from each satellite. The "subject" of the uploaded file should be posted as "Field Day Greetings," and addressed to "ALL." The purpose of this portion of the competition is to demonstrate digital satellite communications to other Field Day participants and observers.

The following uploads/downloads each count as a five-point digital contact:

(a) Upload of a Satellite Field Day Greetings file (one per satellite).

(b) Download of Satellite Field Day Greetings files posted by other stations. Other non-Field Day files are not to be counted for the event.

Satellite digipeat QSOs do not count for any score, and the use of gateway stations to uplink/downlink is not allowed.

The *Mir* PBBS is not to be used for Field Day operations.

If F-O-20 is active, the JA transponder can be used for analog CW and phone activities under the analog transponder rules, and the JD system can be used as a separate transponder under the digital rules.

Sample Satellite Field Day Greetings File:

"Greetings from K5ERP Field Day Satellite station near Galveston, Texas, with 24 participating members in the HTTY Club. All the best and 73!"

Note that the message stated the call and name of the group, where they were located, and how many were in attendance.

Operating Class and Reports

Stations operating portable and using emergency power (as per ARRL Field Day rules) are in a separate operating class from those at home connected to commercial power.

A Satellite Summary Sheet should be used for submittal of the AMSAT Field Day competition results. A copy of this form will be in the *AMSAT Journal*, or can be obtained from me at the address above for a self-addressed-stamped envelope. Deadline for submissions is August 1, 1995.

Competition was tough in 1994 and should be even tougher in 1995. The station submitting the highest score for portable operation using emergency power will receive a plaque at the AMSAT General Meeting and Space Symposium in Orlando, Florida, in October. AMSAT hopes this event provides satellite operators with the practice necessary to set up a ground station and effectively operate via the satellites in an emergency situation. Remember that Field Day also provides a good opportunity to expose newcomers to the amateur-radio satellites. Most of all, it should be a lot of fun for all who participate.

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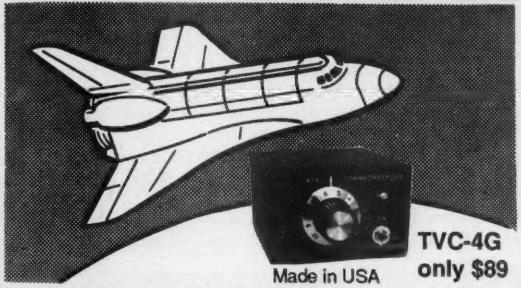

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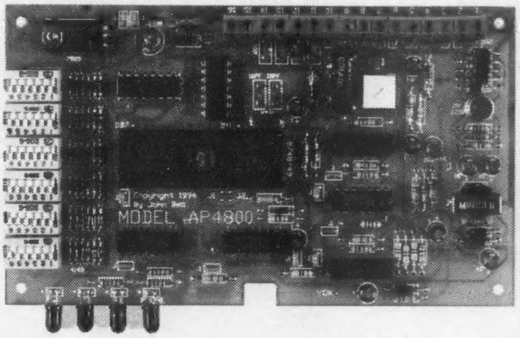

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Wideband Doppler, Part 2

This week, as almost every week, there are several messages on packet bulletin boards and online services from hams wanting to know how to get started in radio direction finding (RDF). Even though most of those writing know little about various RDF methods, many specify that they want information on doppler sets. "Doppler" is the word that comes to mind when most hams think of RDF, despite the fact that it is not the most popular way to do transmitter hunting in many areas of the country, nor is it the least expensive.

Doppler sets are appealing because they provide instant bearing readout and are easy to install and use on almost any vehicle. With a little practice, you can have good results with a doppler in most RDF situations. In "Homing In" for April, I gave you some important design considerations for doppler antennas and described a new switching circuit for the Roanoke Doppler, a popular build-it-yourself RDF set.

The new switcher has lower loss for greater sensitivity, plus better off-whip isolation for steadier readings in areas with high levels of signal reflections. Best of all, it eliminates the need for the coax lines from the switcher to each of the four whips to be a critical fraction of a wavelength. This means that a much wider frequency range is possible for a given antenna set.

More Than 2 Meters

Theoretically, the radius of rotation of a multi-whip doppler array (distance along the ground plane from array center to any whip base) must be less than one-quarter free-space wavelength at the frequency being received. This means that the four-antenna square array pattern must not be more than 0.35 wavelength on a side. My experiments and those of others have shown that about 0.22 wavelength on a side is optimum.

Closer spacing increases mutual coupling between whips, which in turn increases undesirable directivity effects. Furthermore, it produces lower deviation of the doppler tone in the receiver, degrading the signal-to-noise performance. Wider spacing increases doppler tone deviation, which can be detrimental on some receivers, depending on their IF filter characteristics.

A 0.22 wavelength array works well over a ±20 percent frequency range. The 18-inch array described in the April issue covers 121 through 174 MHz. Bearing accuracy is unacceptable outside this range. Of course, sensitivity is maximum near the resonant frequency of the quarter-wavelength vertical whips.

Civil Air Patrol volunteers, Coast Guard Auxiliary members, and others interested in search and rescue can use this array on the 120 MHz aircraft band and the 160 MHz marine band. Keep in mind that Doppler processing works only with FM receivers. A scanner or marine set receives narrowband FM from 138 to 174 MHz, but most scanners and all transceivers have only AM detectors in the 120 MHz aircraft band. They won't work with a doppler RDF set. Instead, you must use a receiver that features selectable narrowband FM mode for the aircraft band, such as the Regency MX-7000.

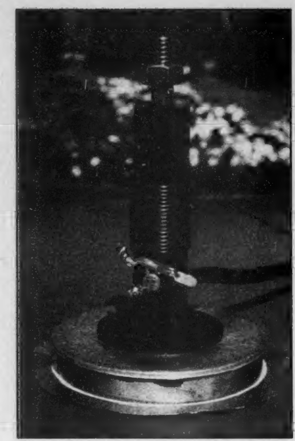

Photo A. Inside the base of the Barjan 11 meter antenna before modification. Note the white insulating paper between the magnet and the bottom foil.

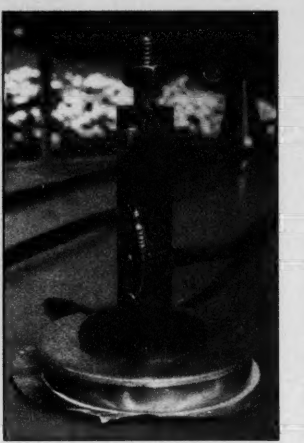

Photo B. The antenna base modified for doppler use. After taking the photo, I added some electrical tape to prevent a short from the PIN diode cathode to the resistor lead.

The new wideband switcher can be scaled for other VHF and UHF frequency ranges. Tom Lewis AB5CK of North Richland Hills, Texas, had been unsuccessful in modifying the original Roanoke Doppler antenna to work on the 70 cm band. I encouraged him to try the new switching circuit with appropriate whip length and spacing. He built a one-piece array with 6-inch-long whips in a 5-inch square pattern. Inductors and capacitors were selected for UHF.

"The 440 operation was fantastic," Tom says. "It worked just as well as I could expect a doppler to work. A friend of mine has a 440 MHz repeater and he was having interference that would kick up the squelch and cause havoc. I hooked up the doppler and within a half mile of the repeater I found a television preamp that was radiating a very low level spur on his input frequency. You figure that if a signal that weak can be detected a half mile away, it's doing pretty well."

Figure 1 gives array sizes and component values for doppler antennas centered on three UHF/VHF bands. You can use this data to build one-piece arrays on a metal plate, like the one in the T-hunt book. The length of the corner radials extending from the whip base should equal the whip length. Turns data for inductors are for single-layer close-spaced chokes on 3/16-inch forms, wound with AWG 26 enameled wire.

More Frequency Agility

Some commercial doppler sets have individual magnetic-mount whip bases instead of a one-piece array. Coaxes from each whip go inside the vehicle to the switcher, located in the control/display box. One set of whip bases can be used over a very wide frequency range by placing them on the vehicle roof at appropriate spacing for the frequency of the hunt.

The requirement for exact dual quarter-wavelength coaxes between switcher and whips made it impossible

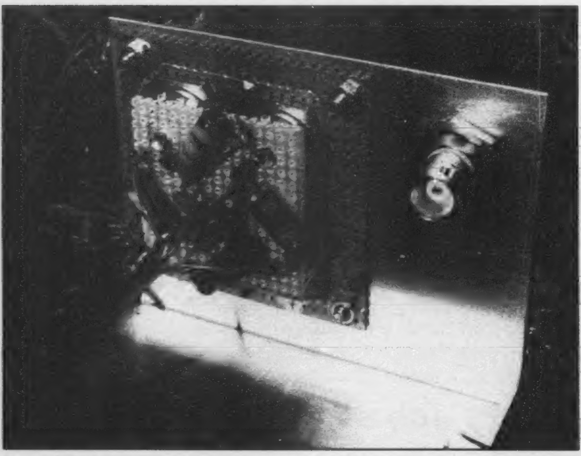

Photo C. The new Roanoke Doppler antenna switcher mounted on the back panel of the display box. The two display circuit boards and their connectors are not installed yet. A short length of RG-58 coax (not shown) ties the switcher common point to the BNC feedthrough adapter for connection to the VHF receiver.

Photo D. Magnetic-mount doppler whips can be placed quickly on any vehicle with a ferrous metal top and moved about to cover a wide range of frequencies. Now my second car has RDF gear on board.

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to do this with the old Roanoke Doppler switcher. Coax lengths are not critical with the new switcher (so long as they are equal lengths). So I decided to make a mag-mount antenna set to go on my commuting vehicle.

The VHF mag-mount mobile whips I saw at ham stores and in the catalogs were all too expensive for my taste. They were also difficult to modify for PIN switching. Admittedly, my search was not exhaustive, so let me know of any that you find suitable. Remember that four are required, which escalates the project cost.

While gassing up at a truck stop, I discovered some Citizens Band whips by Barjan Products (Model 300-102). They have large magnetic bases, making them easy to modify. The whip holder has a setscrew mount, so exchanging whips for band changes is simple. Best of all, they are cheap by comparison. Other brands of CB antennas with base loading coils and 36-inch radiators should work as well for this project.

Modification of each antenna was easier than I anticipated. I removed the whip and holding nut, then carefully slit the bottom foil to remove the plastic base cover (see Photo A). Besides covering the magnet to prevent paint scratches, the foil provides capacitance coupling of RF to the ground plane (vehicle body). As supplied, the foil is insulated from the magnet and coax shield. This is important, because the coax shield is not DC-grounded with the new switcher.

After unwinding the 11 meter loading coil and removing the matching capacitor, there is plenty of room to wire in a PIN diode and current limit resistor, as in Photo B. To minimize loss, I shortened the 17-foot coax lines to a length appropriate for my sedan installation. Remember that for accurate bearings, all four lines must be exactly equal lengths.

Cut each vertical element to one-quarter wavelength, calculated with the standard formula L = 2808/F, where L is element length in inches, and F is frequency in MHz. For the antenna base of Photo B, the feed point of the radiating element is the cathode end of the PIN diode. Taking into account the length of the whip base and the depth of the hole in the whip holder, the 3/32-inch diameter CB whip must be cut to 16.9 inches to achieve an effective 19.25-inch quarter-wavelength element for 146 MHz. I cut the leftover rods into whips for the 125 and 70 cm bands. You could also use 3/32-inch diameter welding rod (stainless steel or bronze) to make whips.

The etched boards by Marty Mitchell N6ZAV for the Roanoke Doppler control circuits fit into the 6 x 4 x 3-inch painted aluminum cabinet (LMB model CR-643) shown in the T-hunt book, leaving room on the back panel for the new antenna switcher (Photo C). This switcher is built on a 2-1/2-inch square of perforated board, copper-clad on the interior side. The CB antennas came with PL-259 connectors, so I installed four SO-239 receptacles. For UHF, it might be better to convert to BNC fittings for minimum loss.

I used a Dremel Moto-Tool as a router to insulate the center of the board where the four single-hole coax fittings mount. This part of the board floats at +3.7 volts DC, so use care to prevent the coax connectors from shorting to the box. A "nibbling tool" is an easy way to make a two-inch square hole in the rear panel to clear these connectors.

A 1-1/2-inch square piece of unclad perfboard fits over the center pins of the coax receptacles. Four capacitors (C101-C104), four PIN diodes (D101-D104) and four RF chokes mount on this board. C105-C108 connect between this board and the isolated return on the copper-clad board. Keep leads as short as possible on all these components and make sure the path length through D101-D104 and C101-C104 from common point to center conductor of each SO-239 is equal. Note the symmetry of the layout in the photo.

When it was time to make the RF chokes, I was out of plastic rod stock, so I wound each on the shaft of a 3/16-inch drill bit, taped down the ends of the winding, and brushed on some Q-dope. When the coating was dry, I could slide the choke off the bit in one piece (with a little persuasion) and install it. Covering the installed choke with more Q-dope will prevent it from peeling apart because of road shock and vibration. (Hint: Finished coils are fragile before the second coating. It's easier to strip enamel from the wire ends before winding instead of afterwards. It takes 19.5 inches of wire to make a 24-turn coil.)

Inductors and capacitor values are not nearly as critical as whip length and spacing, so long as these components have self-resonant frequencies near the high end of the array operating range. For the mag-mount switcher, I used values for the 2 meter array listed in Figure 1. If you will be using yours mostly on another band, choose values from Figure 1 accordingly.

Using the Mag-Mount Array

Be sure that your array "rotates" in the proper direction and in proper sequence. I numbered the whips from 1 to 4 going clockwise (as viewed from above the car), beginning with the left front (LF). To minimize the chance of installation error, I marked the whip bases, coax plugs, and box receptacles with location designators (LF, RF, RR, LR) instead of numbers.

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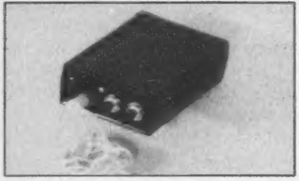

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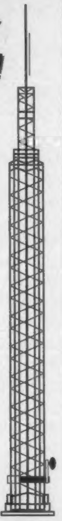

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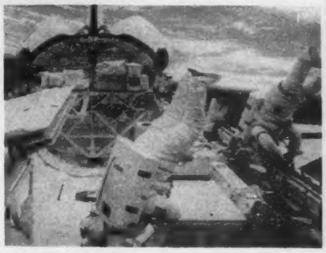

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sides is given by the formula D= 2630/F, where D is distance between adjacent whips in inches, and F is received frequency in MHz. This distance is not critical, but use care to place the whips in a perfect square pattern on the roof and align the array sides parallel to the sides of the vehicle.

It's tedious to set out the whips using just a ruler or tape measure. I made separate cardboard templates for optimum 146, 223, and 440 MHz spacing. Cutouts in the template corners match the whip bases. Emplacement is fast and misalignment is avoided with the templates. Once the whips are in place, I remove the template so it doesn't get rained on or blow away.

When changing bands, check the bearing accuracy of your setup using a known signal source before setting out to find an unknown emitter. In my case, readjustment of the calibration control has not been necessary when whip length is within 20 percent of resonance. On the other hand, using 2 meter whips on 224 MHz gave about 90 degrees bearing error. The presence of other VHF antennas on your vehicle may cause bearing error on some bands.

In my trials with the Roanoke Doppler and new switcher, I generally had excellent bearings on vertically polarized signals that provided at least moderate quieting of the receiver. As all doppler users quickly learn, your bearings on a given signal are best when you are driving in an area that is higher than surrounding terrain and away from buildings and other reflectors of VHF signals. Elevated freeways are great for bearing-taking; canyons are bad.

Similarly, you will always get better bearings on signal sources that are high and in the clear. For example, it seems that no matter where I drive, I get steady bearings on repeaters atop Mount Baldy. On the other hand, low-level repeaters and base stations around Fullerton, while much closer, give wandering or fluttery bearings even when I am mobiling high and in the clear. The low-level stations have many nearby objects to provide signal reflections. This creates apparent multiple sources with composite phase variations that the doppler has difficulty resolving. (Hiders take note.)

Not For Strong Signals Only

Doppler sets are often perceived as inferior to beams and quads for VHF RDF because of the low gain of quarter-wavelength whips and loss in the switcher. But some hams have found that a well-built doppler can track signals that don't show on the S-meter. They may not even be intelligible.

Tom Lewis AB5CK tells of just such an instance. "Someone called me about a signal that was QRMing a major repeater. I went out with the doppler and I couldn't hear a thing. They said it was definitely there and had been been on for three days. I was thinking I would have to get the beam out, but I tried opening the squelch first. I heard a DF whine in the audio and the LEDs were jumping all over the place. They 'leaned' in one direction, so I went that way. The QRM signal began coming in stronger and stronger and eventually I found it. So the Roanoke Doppler will track signals below the noise floor."

Jerry Boyd WB8WFK of Albuquerque, New Mexico, made a similar discovery. "I found with the Roanoke that when the signal is weak and you can barely hear it, it will still track. I added a buffer in my 2 meter FM radio to tap out the 10.7 MHz IF. Using a battery-powered shortwave SSB receiver connected to this tap, I can hear the carriers when all I can hear on the FM detector is noise. During tests using transmitters at known locations, it was tracking these weak signals. There was some bearing error, but it would at least steer you in the correct quadrant."

Nowadays, when tracking a very weak signal, Jerry uses the SSB receiver on the IF to tell if a carrier is present. If so, he opens the squelch to attempt to get a bearing. He sets the damping control at maximum so noise and modulation will have minimum effect on the readout.

Finale

Grab a red pencil and make a couple of corrections to the switcher schematic on page 73 of the April issue. The PIN diodes at the common point ends of the four coax lines are correctly designated D101 through D104. The diodes at the whip ends should be D105 through D108.

I'm interested to know of your successes with the Roanoke Doppler and its new antenna set. For that matter, I want to hear all about transmitter hunting activities in your area. Action photos are always welcome, too. Send postal mail to the address above and E-mail to my new Internet address (HomingIn@aol.com) or to CompuServe (75236,2165).

	VHF–High	UHF–Low	UHF–Mid
Design center (MHz)	146	224	440
Frequency range (MHz)	121–174	185–270	370–530
Whip length (inches)	19.25	12	6
Whip spacing (inches)	18	12	6
C101–C109 (picofarads)	680	470	220
L101–L105 (microhenries)	1.5	1.0	.47
Homemade choke turns	24	20	12
JW Miller choke	4604	4602	9230–12

Figure 1. Array and component data for the new Roanoke Doppler Switcher for three popular bands. You can easily scale the array for other VHF/UHF ranges.

HAM HELP

Number 16 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

WANTED: Information about FAIRCHILD Oscilloscope Module 74-94A, and FAIRCHILD Main Frame 765. I need the schematic and service manuals. *Blase J. Furfaro W7ISJ, 10332 Camino De La Placita, Tucson AZ 85748. Tel. (602) 886-3087.*

NEEDED: Any information, plans, schematics, etc. for a HALLICRAFTERS Model SX-62 shortwave and broadcast bands Receiver. I will gladly pay for any copies and postage for any of the above. *Lyle L. Goheen N7VUE, 2038 Palm St. #508, Las Vegas NV 89104.*

My physiology laboratory is studying the behaviour of the three-toed sloth (Bradypus Variegatus), using short range (50m) bioteletry. Could any fellow radio amateur help me to find a source (or donate) a good quality broadband receiver covering 145-160 MHz FM, and a small motor drive able to rotate a mini video camera in X-Y axis? *Carlos peres da Costa PY7-CPC, Depto. Fisilogia e Farmacologia. C.C.B., Universidade Federal de Pernambuco, RECIFE PE 50 .970-090, Brazil, South America.*

I need the assembly and operating manuals for the HEATHKIT Oscilloscope, model IOD-4540. I will pay for copies and mailing costs. *Ken KF8BC, 7716 Oceola Lane, West Chester OH 45069. Tel. (513) 779-4148.*

NEEDED: Copy of the manual for KENWOOD TMZ01A 2 meter Mobile Radio. TNX. *Art Coulombe W7HGK, 21 Yakima St., Walla Walla WA 99362.*

VIZ MASTER VOLTOHMYST, MODEL WV-510A. Strong resemblance to the early 70s RCA Senior VoltOhmyst housed in a blue die cast case. Could really use a schematic, an operators' manual would be a plus. Copy costs and/or shipping costs will be covered. *John Pakusich WB6KVF, 720 Walker Ave. #6, San Pedro CA 90731.*

WANTED: *73 Amateur Radio* (April, 1967) with Alfred E. Neuman cover. Will pay top $$$. Multiple copies wanted. Please contact *Michael Lerner, 32862 Springside Lane, Solon OH 44139. Tel. (216) 349-3776.*

I am eleven years old and am starting an amateur radio call license plate collection. If you have changed your callsign and have a now-out-of-date license plate, please write to me. *Michael Spenn, Box 33216, San Antonio TX 78265.*

I am looking for manuals and schematics for: CENTRAL ELECTRONICS Model MM-2 "Multi-Phase RF Analyzer;" HEATHKIT HD-1422 Antenna Noise Bridge; JACKSON Model 640 "Test (RF) Oscillator;" and HEATHKIT HD-1 Harmonic Distortion Analyzer. I will gladly pay costs of copying and postage. *John Sehring WB2EQG, P.O. Box 373, Baker MT 59313. Tel. (406) 778-2452.*

I would like to get in contact with anyone receiving WEFAX signals direct on 1691 MHz, within a 60 mile radius of South Bend IN. *Jim Kocsis WA9PYH, 2217 Hidden Oaks, South Bend IN 46628. Tel. (219) 277-1786.*

I am looking for manuals and schematics for: 1) CENTRAL ELECTRONICS "Multi-Phase RF Analyzer," 2) HEATHKIT HD-1422 Antenna Noise Bridge, 3) JACKSON Model 640 "Test [RF] Oscillator," and 4) HEATHKIT HD-1 Harmonic Distortion Analyzer. I will gladly pay costs of copying, and postage. *John Sehring WB2EQG, P.O. Box 373, Baker MT 59313. Tel. (406) 778-2452.*

I need the assembly and operating manuals for the HEATHKIT oscilloscope Model IOD-4540. I will pay for copies and postage. *Ken KF8BC, 7716 Oceola Ln., West Chester OH 45069. Tel. (513) 779-4148.*

I have a printed circuit board 3 3/4" square, with the letters "WD5HSN," and some other parts for an alarm system. I am looking for a schematic, or any other information about this system. Thank you. *Judson White WA2PMH, 50 N. Greenwood Ave., Hopewell NJ 08525.*

WANTED: Manual or partial copy for HEATHKIT Models SB313, SB300 and SB400. *Robert Schlegel N7BH, 2302 286 St. East, Roy WA 98580.*

NEEDED: Contact with SSTV operators using (AEA) AVT terminal with AMIGA computers. I require assistance with various procedures and programs. Many thanks. *H. Rothenberg ZS6JH, P.O. Box 84053, Greenside 2034, South Africa;* or FAX: *27-11-646-8436.*

Could anyone supply me with a 5-pin short wave coil salvaged from a late 1950s KNIGHT Kit "Ocean Hopper" regenerative Receiver Kit? I prefer junk box donations but will gladly purchase a whole unit if it includes the cabinet and all five coils. *Al Cikas KA9GDL, 412 Radford Dr., Sherman IL 62684.* TNX.

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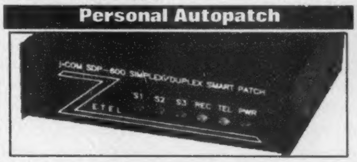

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SWR Primer for VHF through Microwave, Part 2

Last month I covered the application and comparison of an SWR measurement system as it applied to both VHF and the microwave bands. In it I discussed our group's efforts to make meaningful measurements with simple equipment in the low frequency to 10 GHz microwave bands. This month I want to cover other aspects of SWR and circuit testing, describing other devices to aid our function tests.

Some of these new devices rely on magnetic action to do their jobs. This is different from the directional coupler described last month, which uses "static," or non-active, lumped components. These microwave magnetic widgets include magnetic isolators and magnetic circulators. These are basically inactive in that they do not require power but rely on a high intense magnetic field set up by permanent magnetics on the devices.

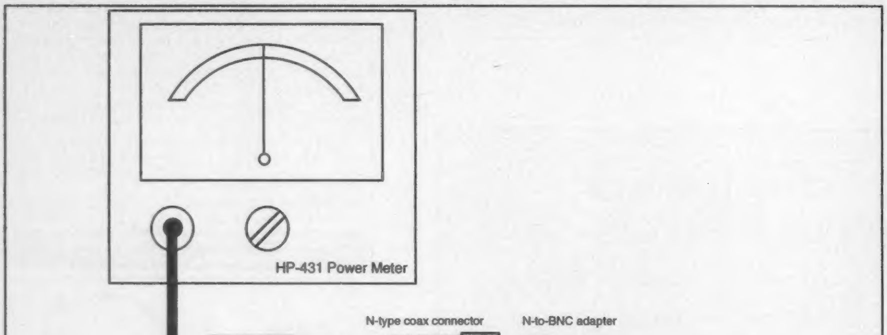
I have received many inquiries on these devices and it's a good time to include them in a short discussion. These devices, along with other microwave bits and pieces, can be picked up via surplus, or at many of the swap meet sources. I imagine Dayton would be an excellent source for this material if you are interested; it's the largest swap meet of all. I have never been there but have seen photos of the swap meet area, and it's huge. I plan to go there when I win the California Lottery. Well, then, let's get some test configurations set up and put to use some of these many different microwave widgets.

The Necessary Test Equipment

In each example I want to cover both the setup and arrangement of equipment for specific tests. All of the test configurations will use equipment that I have obtained via surplus and swap meet sources. This equipment is not the latest, as most of it was manufactured in the mid '60s through the '80s. I have to admit that it has taken a lot of scrounging over the years to pick up this equipment, but for want of a good microwave test bench nothing else would suffice.

What do you need? In the microwave world you need several different pieces of equipment: power meters, frequency counters, detectors, signal generators, sweep oscillators, frequency standards and noise figure test sets. These are the major league players. Life without some of them can be frustrating when you delve into this edge of the spectrum. If I were to recommend a single piece of test equipment, it would be the power meter. Power meters are able to detect very small changes in forward or reflection measurements.

The next most asked question is, "What kind of power meter do I recommend?" Well, there are three possibilities: General Microwave, Hewlett Packard and Brand X. I use the HP-431 power meter, while Kerry N6IZW uses the GM meters. Both work equally well and are just as accurate for our purposes. Our individual choices were not a matter of preference but rather what we each picked up in the beginning. When I find GM equipment I give it to Kerry, and in return he does the same for me with HP equipment.



Hewlett Packard 431C Power Meter with cord and RF head, type 478A thermistor detector. Power range -30 dBm to +10 dBm. Extend power capabilities with external power attentuators.

Example: If testing 2 meter HT at approx. 2 watt output level. Read power meter on scale, 3 dBm + 30 dB attenuator = 33 dBm power, or 2 watts.

Figure 1. Sample setup HP-431 microwave power measurements.

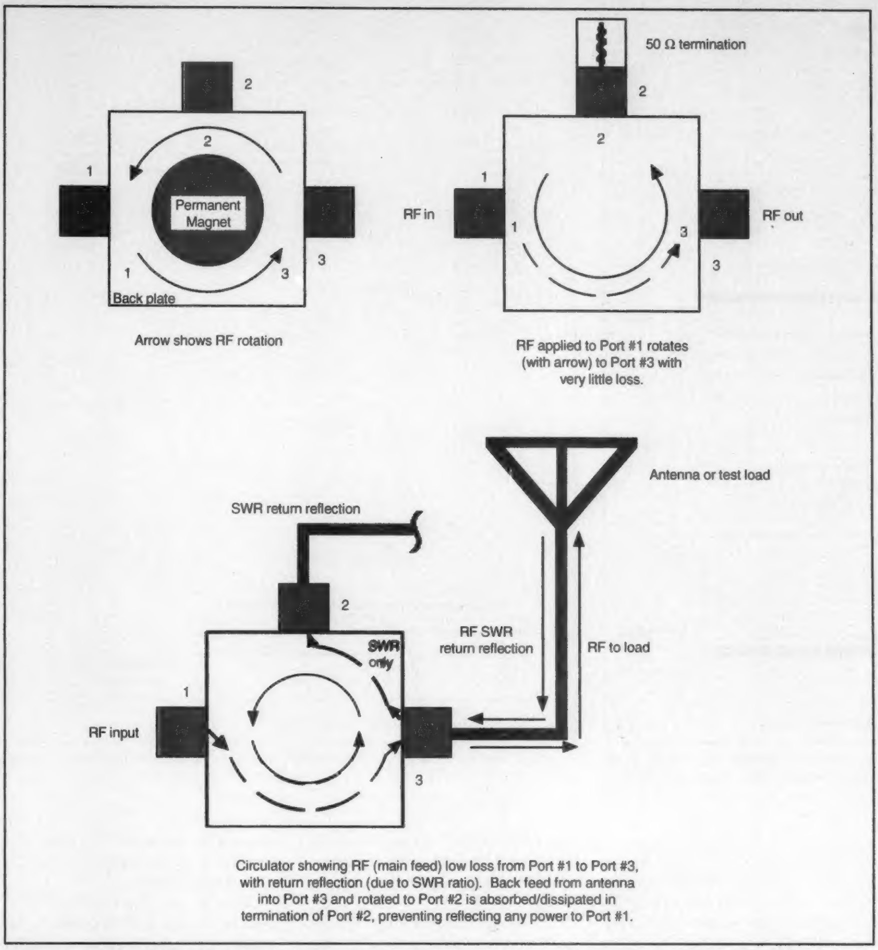
Now, the big question: How do we test or determine what is an acceptable level of performance for other devices we will use with the power meter for tests? The difference is the return loss of the item under test, or simply the SWR of the individual device. If you measure return loss and the difference in power levels from forward to reflected is in the 10 to 14 dBm range, your device or SWR meter has a problem at this frequency. It's the same thing as saying it has power SWR. The dB readings indicate an SWR ratio ranging between 1.6-3.0 to 1. Such readings indicate a very poor level of performance. If the difference is between 20 to 25 dBm, the SWR meter has an internal SWR of between 1.2 and 1.1 to 1, which is quite acceptable for most uses. Some of the commercial surplus microwave test equipment that I have tested exhibited return loss in excess of 25 dBm, a very good SWR.

Why, then, do these microwave parts cost so much when new? It's not that the basic equipment is that expensive to manufacture; it's the high level of testing that goes on to ensure that the device is well matched over its intended working frequency range. Labor cost to calibrate microwave devices to specifications is the big addition to the equipment's price tag, not the equipment itself. Simply stated, return loss in the 25-some dBm range is quite good and relates to an SWR reading of nearly 1.1 to 1, which leaves us feeling warm and cozy.

Now the tough part: At minimum, what other devices coupled with our power meter do we require to perform these tests? A suitable start would be to collect a variety of both coaxial and waveguide directional couplers and circulators. Don't let the word "microwave" disturb you when you go looking for a suitable power meter. Almost all power meters will function accurately over a frequency range of 10 MHz to over 12 GHz. Just remember, microwave power meters are not calibrated in "watts," but rather in "milliwatts," and require suitable attenuators to protect the power meter when reading powers that are unknown or much higher than the +10 dBm rating of most heads.

With suitable attenuators a high power can be very accurately measured on these microwave power meters. For example, if I wish to measure my 2 meter HT (approximately 2 watts) on a VHF power meter, like a Bird 67 wattmeter, I read about 2.1 watts. The difference between 2 watts and 2.1 watts is a meter needle width and subject to parallax interpretations. If I make the same test on an HP-431 power meter (maximum power to the meter head: +10 dBm) with a 30 dB attenuator (coaxial), I can make a very accurate power measurement.

Let's take a close look at what is going on. Two watts of power is the equivalent in dB to 33 dB of power (see Figure 3 for details). Under this



Arrow shows RF rotation

RF applied to Port #1 rotates (with arrow) to Port #3 with very little loss.

Circulator showing RF (main feed) low loss from Port #1 to Port #3, with return reflection (due to SWR ratio). Back feed from antenna into Port #3 and rotated to Port #2 is absorbed/dissipated in termination of Port #2, preventing reflecting any power to Port #1.

Figure 2. SWR power in a circulator, magnetic rotation or circulation of RF power in a magnetic circulator.

test I have a meter scale that is almost 10 times in length to make an accurate determination and an actual power meter reading of 2.24 watts of power. Now, in reality, this slight difference will not amount to a hill of beans at 2 meters. However, at microwave frequencies this power increase is very significant and can be the difference between fine-tuning an amplifier or not obtaining good results by looking for bigger increases. Microwave peaking is accomplished by fine-tuning and careful adjustment. Know the capability of your metering system.

Circulators

Up to this point we have confined our demonstrations to directional couplers. There are other devices that work somewhat in the same manner: circulators and three-port circulators. Circulators and three-port circulators are all the same, it's just that some only bring out two ports and internally terminate the third port. These devices differ from directional couplers in that they don't operate by a coupling action, but rather by a magnetic rotation of RF within the circulator. The name is derived from the magnetic function causing the RF power applied to an input port to be rotated about the device. The RF rotates in concert with the magnetic lines of force in a circular motion through the device, hence the name, circulator.

The device consists of three ports and a back plate (or four ports if you prefer, but in reality the back plate is never counted as a port because it is always internal). Sometimes the reflection port is permanently terminated in 50 ohms. In use, RF power applied to port 1 is reflected off the back plate and feeds port 3 with all RF received from port 1, less minimal internal losses. Let's assume port 3 is an antenna. If the antenna is a good match, very little RF is reflected back into port 3.

I assure you there will be RF reflected back into port 3, as only a perfect match will cancel out reflections. Perfect is desirable but not attainable; a compromise is more normal in the imperfect world due to the SWR ratio or less-than-perfect match at the load/antenna port. The rotation of reflected RF is the same as before and would continue, except it is dissipated in the port 2 load by a 50-ohm resistor. In some cases this termination resistor is coaxially connected and removable. If you have a removable termination at port 2 you can connect a power meter in its place and measure the reflection return power at port 2. See Figure 2 for details. In essence, you don't need to know what the SWR ratio is—you just adjust the load for minimum reading at port 2.

What, then, is the difference between a magnetic circulator and a magnetic isolator? A magnetic isolator is similar in action, but is used only as a two-port device. It is usually used only as a waveguide component and has a very large permanent magnet attached to a short section of waveguide. The action of the large magnetic field allows RF to flow in only one direction with a minimum of RF loss. In the reverse direction it has maximum loss, with the RF trying to flow backwards through the intense magnetic field. Magnetic isolators are used to prevent any reflected RF from reaching the RF source and upsetting it. They are similar to circulators but do not have any means of dissipating excess reflected power. Isolators are just that—big, bulky devices providing isolation between devices by restricting RF to flow in one direction only. See Figure 6 for details.

All devices described up to now are suitable for making SWR measurements, or for use as an aid in making RF measurements for other setups and applications. The most accurate device has yet to be described. It is called the slotted line.

The Slotted Line

The most accurate measurement device used to make SWR measurements or other power measurements in a transmission medium is the "slotted line." (See Figure 4.) This device will make very accurate SWR readings along a slot or opening in the transmission line into which a probe is inserted to sample RF along a transverse path. A modulated RF source is used for this measurement to drive the input of the slotted line. The test device (an antenna, in this case) is connected to the output of the slotted line. Measurements are made when the probe (inserted into the slot) is moved about the length of the slot and readings are noted on a specially-built SWR meter. This meter is actually an audio frequency voltmeter with a special filter of very narrow bandwidth at 1 kHz. This meter connects to a detector diode that is part of, or is coaxially attached to, the probe on the slotted line.

The SWR meter used in this case is nothing more than a selective 1 kHz highly-calibrated audio detector that is used to detect the audio modulation envelope on the RF envelope. Measurements are made at maximum and minimum readings on the SWR meter, and the standing wave ratio (SWR) is read on a scale of the meter (1 kHz modulation for this test is industry standard). In a nearly perfect termination, the forward and reflected RF products in the slotted line will have a power reference that is nearly unchanged. As such, the peak value of the modulated RF envelope will remain nearly unchanged as readings are made with the probe moving along the slot. Example: If all the power is absorbed in the load (the antenna, in this example), there will be a *very low* SWR, 1.1 to 1 or less.

In actuality, there will be a maximum and a minimum reading on the SWR meter, but the difference be-

dBm vs. Power (Watts)

0 dBm	1 mW
5 dBm	3.16 mW
10 dBm	10 mW
15 dBm	31.6 mW
20 dBm	100 mW
25 dBm	316 mW
30 dBm	1.000 watt
35 dBm	3.160 watt
40 dBm	10.000 watt
45 dBm	31.600 watt
50 dBm	100.000 watt

Figure 3. Chart for RF power in watts and conversion to power in dB equivalent. For each power increase in 3 dB steps, actual power in watts doubles.

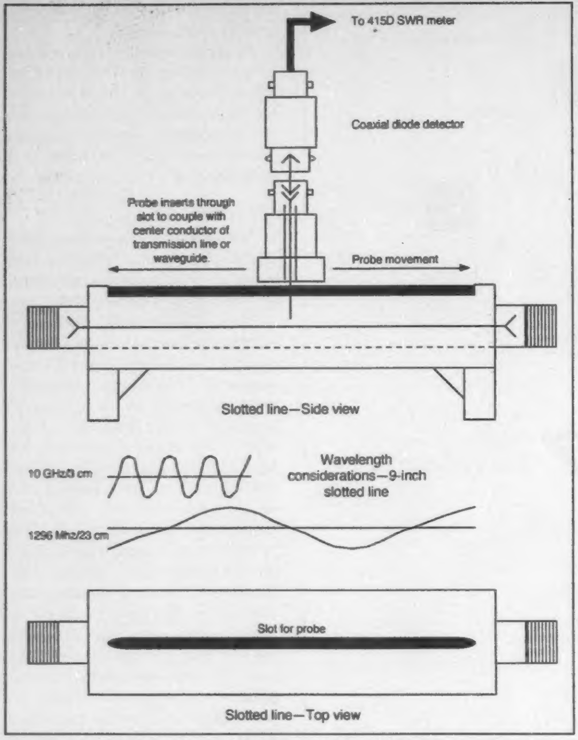

To 415D SWR meter
Coaxial diode detector
Probe inserts through slot to couple with center conductor of transmission line or waveguide.
Probe movement
Slotted line—Side view
10 GHz/3 cm
Wavelength considerations—9-inch slotted line
1296 Mhz/23 cm
Slot for probe
Slotted line—Top view

Figure 4. Slotted line in respect to wavelength considerations. In general, small components are good for very high microwave frequencies, and large components are suitable for much lower frequencies.

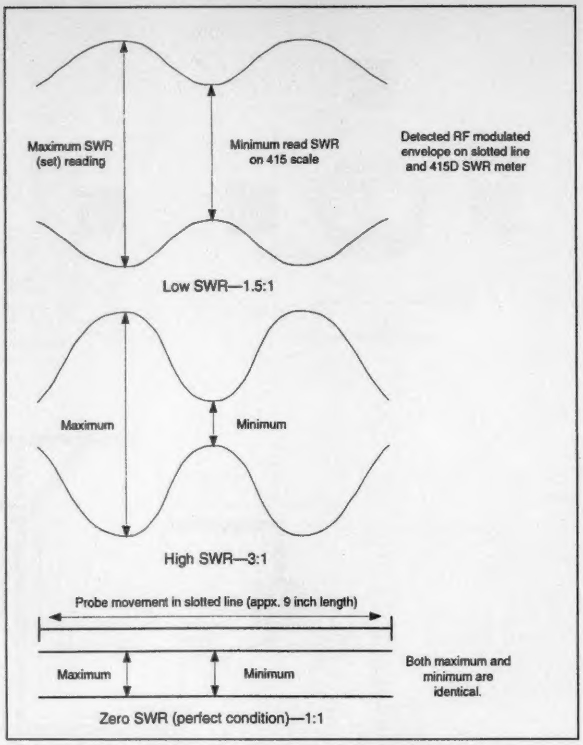

Maximum SWR (set) reading
Minimum read SWR on 415 scale
Detected RF modulated envelope on slotted line and 415D SWR meter
Low SWR—1.5:1
Maximum
Minimum
High SWR—3:1
Probe movement in slotted line (appx. 9 inch length)
Maximum
Minimum
Both maximum and minimum are identical.
Zero SWR (perfect condition)—1:1

Figure 5. SWR, showing modulated RF envelope vs. slotted line probe movement.

tween these two readings will be very slight, indicating a very low SWR reading, or a nearly perfect match. As the difference between the readings gets bigger, the SWR value increases as well. The value of using this system is that it is capable of showing very fine increments of SWR readings at almost any frequency where you have a slotted line carriage to test from.

The principle for all frequencies is the same: If the SWR of the antenna is not a good match, part of the power applied to the antenna will be reflected back to the source. The reflected RF will cause a minimum and maximum RF in the slotted line due to different phase relationships and other factors. This is what SWR is all about, without getting really technical. It's sufficient to say that in the transmission line or slotted line there will be minimum RF at some point and maximum RF at a point further down the slotted line. The actual SWR will be a ratio of the RF maximum-to-minimum readings.

We don't want to measure the RF power in this case. Rather, the modulation on the RF wave (the 1 kHz modulation) is detected in the HP-415 D SWR meter (the 1 kHz receiver in this case). SWR readings are accurate to extremely small increments using this setup. The SWR readings are displayed directly on the face of the HP-415 meter. In use, we calibrate this meter for maximum peak RF in the slotted line and "set" a reference point in the HP-415, then move the detector probe to a minimum in the slotted line and read the SWR directly from the face of the HP-415 SWR meter (the 1 kHz receiver). It's very simple, but you have to have the tools to get the job done.

At lower frequencies, the modulation from a precise 1 kHz source can be used to modulate a signal generator in the 500-to-several-GHz range. The HP-415 SWR meter does not care where the RF or modulation comes from, as long as it can recover enough detected RF with associated 1 kHz modulation to allow calibration of the HP-415. A suitable much longer slotted line would have to be used at these lower frequencies. At 500 MHz, a slotted coaxial line would be about 8 to 10 inches long for minimum results.

Using a Modulator

Modulating an RF signal at the high microwave frequencies can be difficult, but with a device called a "PIN modulator" the job is quite easy. A PIN modulator is like the PIN diode switch found in most newer VHF transceivers, used to switch from receive to transmit on the RF coaxial feed. In the modulator application, 1 kHz is applied to the diodes, rather than switching DC bias. The diodes turn on and off at a 1 kHz rate, in effect causing RF to be modulated by the 1 kHz bias. In my test setup for 10 GHz I use a surplus HP-8734A PIN modulator driven by a 10-mW Gunn source set to the frequency of interest. This setup is then fed to the waveguide slotted line, which attaches to the antenna or device under test (DUT, for short).

To set calibration on this type of system, it's only necessary to bring the meter to an RF maximum point on the slotted line and set a zero reference, then reposition the slotted line to an RF minimum and read the detected modulation and the corresponding SWR off the meter face. At 10 GHz, for example, it is possible with this setup to make meaningful SWR readings like 1.02 to 1. It's quite an accurate device. An analogy at HF, 3 to 30 MHz, would be to have the school football field laid out with a similar slotted line. As you can see, this is not practical due to the very long wavelength at these frequencies. The slotted line is useful at 500 MHz and above due to the same wavelength size considerations.

For a slotted line to be useful, it must be long enough to contain a full half-wavelength at minimum. Lengths at 1296 MHz and above would not be a problem as a full wavelength at 1296 MHz is 23 cm, or about nine inches long. Half of that is 4.5 inches—well within the six-inch slotted coaxial line I am using. However, at 450 MHz a half wavelength is just over 13 inches and not usable on this short six-inch slotted line. See Figure 4 for details.

Well, that's it for this month. As always, I will be glad to answer questions concerning this and other related microwave VHF/UHF topics. Please send an SASE for a prompt reply. 73 Chuck WB6IGP.

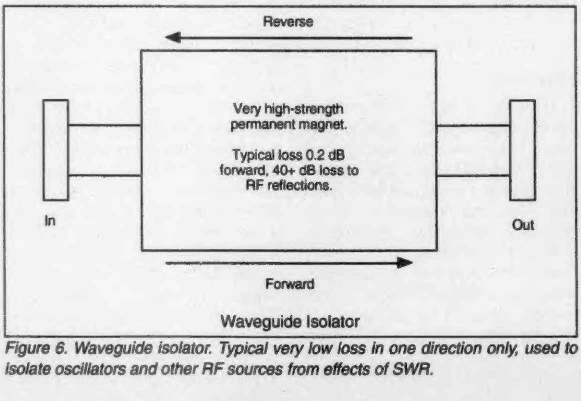

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Figure 6. Waveguide isolator. Typical very low loss in one direction only, used to isolate oscillators and other RF sources from effects of SWR.

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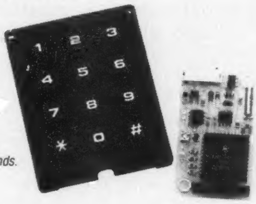

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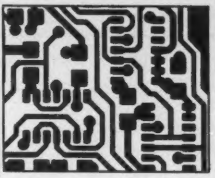

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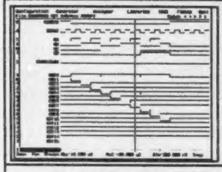

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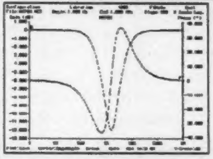

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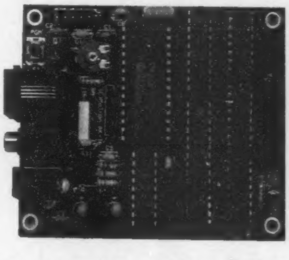

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ATV

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Photo A. Left to right: Andrew Mossberg KE4RKZ, Tom Bales KE4SYS, Ted Slack KE4SEM, Korey Kline, Kevin Smith N4SMZ and Adam Germann prepare to fly the ATV rocket.

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Rocket-Powered ATV

In early April, I attended a high power rocketry event sponsored by the Tripoli Rocketry Association. Located at a site called the Spears Range, near Manchester, Tennessee, this weekend event drew rocket enthusiasts from several states and featured moderate to very large rockets that flew nearly continuously during each day from more than nine launch pads. These are not your typical hobby shop kind of model rocket—some really are small sounding rockets!

There were dozens of flights (some to over 10,000 feet) and some very spectacular failures! One flight did three somersaults and buried its nosecone into the ground just in front of the viewing area, with the motor still firing. The crowd had a good laugh when the parachute popped out!

While most of the rockets used a solid fuel engine, there were a few that used a different kind of arrangement. Tim Pickens, from Madison, Alabama, brought out his 11-foot-tall, 55-pound steam-powered rocket (that's right—*steam*). He hooked it up to an AC generator and literally boiled the water in the rocket's tank until it reached the proper pressure. He opened the valve in his steam engine and the rocket headed skyward with an amazing cascade of hissing steam trailing behind. While not the most efficient propellant, it is very inexpensive, and the rocket reached about 500 feet in altitude.

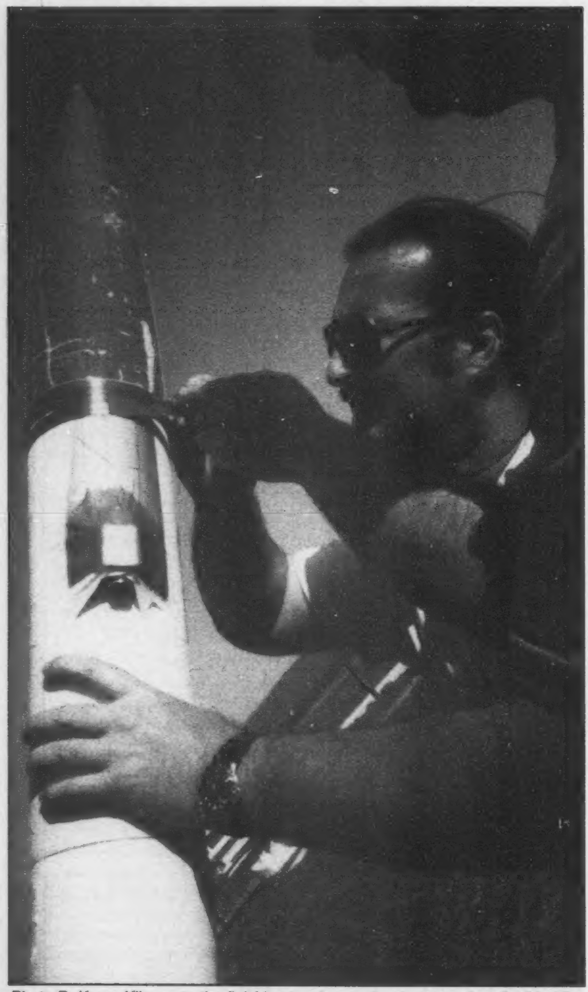

Photo B. Korey Kline puts the finishing touches to the duct tape "cowling" holding the TV camera to the outside of the rocket as Adam Germann braces the fuselage.

I also ran across another propulsion system that was offered by a group called Environmental Aerosciences. Their system is the Hypertek, and is a hybrid rocket engine consisting of nitrous oxide (laughing gas) and thermoplastic. Their ingenious and compact system mounts in a standard rocket motor mount and consists of a pressurized cylinder that contains the nitrous oxide and a disposable plastic tube with an embedded nozzle that is actually the fuel and combustion chamber. This provides a great deal of thrust (comparable to a "J-motor"), but is very inexpensive to fly. All it takes to reload the motor is to replace the thermoplastic fuel grain, fill the nitrous oxide tank while on the pad, and fly again. Their group flew 10 times during the two-day event.

It turned out that most of their group were hams, and they had driven all the way up from Miami, Florida! In their group were Kevin Smith N4SMZ, Ted Slack KE4SEM, Tom Bales KE4SYS, Andrew Mossberg KE4RKZ and Korey Kline. As I observed them prepping another rocket, I asked them if they had had a chance to fly any ham payloads yet in their hybrid rockets. Tom KE4SYS showed me a GPS payload that they had intended to fly, but a glitch in the GPS receiver kept the package on the ground. It was nicely constructed and looked like it could withstand a nuclear blast!

> ***"I guess I must've been standing too close to the nitrous oxide tank when they suggested that I fly my camera on the outside of the next rocket they were preparing, and I gleefully agreed to the lunacy!"***

On the second day of the meet, I brought along my mini-ATV system that I've used as part of the Hat-Cam and have flown on tethered balloons and kites many times. It was definitely *not* able to withstand any high-G impacts or nuclear blasts and was just loosely packaged into a piece of styrofoam. I guess I must've been standing too close to the nitrous oxide tank when they suggested that I fly my camera on the *outside* of the next rocket they were preparing, and I gleefully agreed to the lunacy!

Risky Rocket TV

The ATV system for this rocket consisted of an MVP5 b/w TV camera (available from Micro Video Products) and a postage-stamp-sized micro-ATV transmitter (see the July '91 issue of *73*, page 8, for details). The camera and the transmitter were powered by separate 9-volt batteries. The antenna consisted of a quarter-wave BNC mounted whip.

We used a LOC/Precision Magnum rocket, built by Ted KE4SEM, with an 18-inch-long payload section. This section has a diameter of around 5.5 inches. The micro-ATV transmitter, whip antenna, 9-volt batteries and a lot of bubble wrap were stuffed into the payload section.

The MVP5 camera was mounted to the outside of the payload section with lots of electrical and duct tape. Most other rocket ATV systems I have seen involve mounting a mirror on the outside of the rocket or just sticking the lens out through a hole in the payload wall. Unfortunately, the mirror system inverts the video image, so sticking the whole TV camera outside looking down at the fins provides an excellent view. This camera is well-suited to this kind of application due to its very small size (approximately 1" on a side) and its light weight (just over 2.5 ounces). I would recommend that in a permanent installation you build a small cowling to cover the camera and secure it in place with a 1/4-20 bolt if you ever want to see your camera again in one piece.

After a bit of last-minute adjustment to the aerodynamics of the duct tape "cowling," the Magnum was ready to fly.

A Wild Ride

The suspense was building as the rocket was transported to the pad. We had a beautiful snow-free picture on the TV set in the RV. To eliminate sync loss (and because we had no other way to record the video), we elected to record the image right off of the TV screen. In the subdued lighting of the van, this worked very well indeed. The receive antenna consisted of a hand-held two-element quad pointed at the rocket during the flight.

The hybrid engine was filled up with nitrous oxide, the pad was cleared, and then ignition! The rocket screamed off of the pad while providing us all with spectacular TV images of the flaming Hypertek engine and the smoking exhaust trail as the field got smaller and smaller. Everyone cheered as the parachute deployed at around 1,500 feet and flew by the camera. Kevin N4SMZ made the comment that it looked just like a NASA flight. The rocket gently descended back to the field and the ATV image showed an extreme close-up view of a cow as the payload landed in the middle of the herd.

Even with the low power (80 milliwatt) transmitter, we received a snow-free image during the majority of the flight, with only a few fades at apogee. To top it all off, my TV camera survived the flight totally unscratched!

Although this was a fairly heavy rocket capable of lifting much heavier payloads, you could probably fly this ATV system in a much smaller rocket with good results. ■

Rocket System Parts List

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Micro-ATV transmitter:
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P.C. Electronics
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Arcadia CA 91007-8537
(818) 447-4565
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Findlay OH 45840
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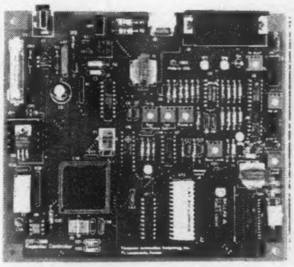

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Field Day

Ah yes, June and the smell of CW floating though the air. Egads, it's Field Day time once again.

Although I really don't like contests, I do enjoy Field Day. I use it as an extended field test for new rigs and antennas. There are signals all over the place, just waiting for you to snap them up.

If everything goes as planned, I will be using the home-brew rig described last month for this year's Field Day. With all the intermod, crud, junk and other critters living on the ham bands during Field Day, I'm sure to find any bugs in the receiver.

Antennas

However, before I connect the rig to the battery, we need a good Field Day antenna. My all-time favorite is the center-fed Zepp feed with 300-ohm TV twin lead. Each side of the Zepp is 65 feet long. This is more than enough to cover 80-75 meters, as well as 40 and 20 meters. Of course, you'll need an antenna tuner to get the antenna to resonance at the frequency you're working on. I use an old beat-up Ten-Tec antenna tuner with balanced-line output. This tuner does not have an SWR meter, so an external meter must be employed, unless your rig has one built in. One of the many MFJ antenna tuners would be ideal, too. They're much smaller than the Ten-Tec unit I've been using.

Before the Field Day activity starts, I tune the antenna to the portion of the band I plan on using, and make up a cheat sheet for quick resetting. This also gives me some idea of what the radiation pattern of the antenna is before the contest gets under way.

If there is both time and space, a second Zepp at right angles to the first one is a grand idea. This way you can select between the two antennas and between the resulting different radiation patterns they produce. A good grade of knife switch makes switching from one twin lead feed to the other guilt-free.

Of course, it goes without saying, the higher the antenna, the better it will perform. I use thin kite cord to hold up the two ends of the dipole. I prefer the cotton line, but will use nylon if need be. The cotton will degrade if pieces of it are accidently left behind. I've used cotton twine several times and it's proved equally useful.

One problem with the twin-lead feed is keeping it from touching objects such as tree limbs and camper rooftops. By using the cotton twine, I can usually make up stand-offs to support the twin lead away from such things. Needless to say, never leave the excess twin lead laying on the ground. Cut off the excess instead of leaving it in a ball on the ground. When you're only running 2 watts, you sure don't need your RF going into the ground.

Power Supplies

For power, I use the best of two worlds: solar and battery storage. I want plenty of juice, so I usually bring along a 25-amp/hour battery and a 10-watt Solarex MSX-10 panel, although I've been known to use a higher-power solar panel of up to 75 watts peak power. With the 10-watt solar panel and the 25-amp/hour battery there is no need for a solar charge controller.

I don't really get my jollies by toting around 60 pounds of lead and acid, so I use a smaller gelled battery. The one I find provides all the power necessary for the 24-hour contest is the type U1 wheelchair battery. Most Sears automotive stores stock this guy. If not, any of the larger battery dealers will have it. Just ask for the 25-amp/hour wheelchair battery, and they'll know exactly what you mean. It will set you back about 60 bucks, but is well worth it. Check the surplus outlets; I've seen the exact same battery for $25 brand-new with warranty.

I've also used a set of two 6-volt gelled batteries. You can pick these guys up at any Toys 'R Us store. They're used in the small electric-powered cars and trucks kids ride in. They're rated at 9 amps/hour, which is more than ample for a QRP FD. With the electrolytic sealed, the battery can be placed in any position, even upside down, without the worry of acid spills on your logbook.

Although not mentioned, it is an absolute must to use fused power cords when running with a battery of that capacity. A short circuit will mean instant meltdown. I prefer to use magnetic circuit breakers instead of fuses. They're extremely fast, and you can reset them after you fix whatever caused it to trip in the first place. I'm sure you can get the magnetic circuit breakers from several different sources, but I use the 9-amp breaker supplied by Ten-Tec. It's the unit used for the Argosy when running from a battery source. It's not cheap, about $20, but it's worth every bit that much when something goes wrong. I'll keep an eye out on the surplus market for these breakers, and if I can find them at a reasonable price I'll let you know.

Computer Logging

Now that we have the rig, the antenna and the power source, how about logging those contacts on a computer this year? I use a program for MS-DOS I picked up as shareware. It's fast, easy to use, and will run on my old Tandy 1100 Field Day laptop. I have yet to find a program for my Macintosh Powerbook that will do all the stuff this one will do. But, I'm still looking.

During the last several years, I've been very laid back when it came to keeping track of the contacts I make during Field Day. In fact, I've been known to not even write any of them down on paper! Since the exchange is so simple, there's no need to get upset if you miss a report or two. Of course, I've not turned in a log to the ARRL in about six years, so I don't need to worry about the finer details of Field Day logging. I will bring along the computer this year for some serious logging.

The old Tandy won't run much over two hours with its internal battery pack, so a patch cord and series regulator tap power from the 24-amp/hour battery. In the "I really don't need to carry this along with me" category, I bring along an extended voltmeter to monitor the battery during the contest. I've never been able to draw the battery down to a discharge state over the 24-hour period.

While the computer is grand for logging, it isn't good for sending CW. Instead, I prefer the old hand-operated electronic key and paddle. It's much faster to send CW with the paddles and keyer than to type it out on the keyboard, at least that is what I think. I use the Super CMOS Keyer as appeared in *QST* several years ago. You can still get most of the parts for this memory keyer. I use the internal battery to operate the keyer, making for one less cable to worry about.

All the equipment I have mentioned only takes up about one square foot of space. Although the battery is a bit heavy, it's easy to lug the setup deep into the woods for some real serious Field Day action. My plan of action for Field Day is rather simple: have fun, have fun, and have fun. 73

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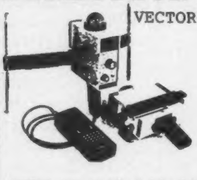

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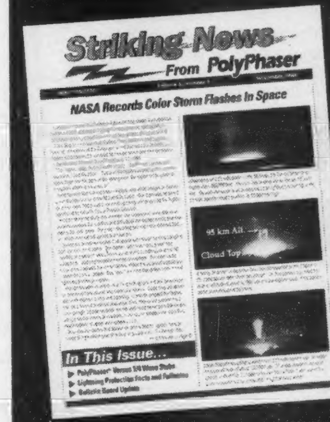

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CIRCLE 49 ON READER SERVICE CARD

RTTY LOOP

Number 20 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
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Somehow, I have the incredible need to tell you that this column marks the end of the 18th year of "RTTY Loop." Eighteen years! To put that in perspective, my son, who was an infant when the first "RTTY Loop" was published, can now vote. Frightening, isn't it? And you don't even know my son.

Anyway, my mailbox is stuffed with all your comments, questions, and suggestions. Miles L. Clouston N8VJM/1 sends along, via E-mail:

BayCom Demodulator

"I was particularly pleased to see that the Software Series is now up to seven volumes. *[It's now 10.]* Now that I am becoming more equipped (from a hardware standpoint) to participate in RTTY and similar modes of communication, it would probably behoove me to have those volumes. Also, are there any plans available for a simple (quick and dirty) hardware interface (modem or just demodulator) allowing me to (at least) copy and (possibly) transmit RTTY? I know that most full-featured modems will do such a thing, but I also wonder if an item such as the BayPac Model BP-1 (with the proper software) would support such activities. I am in the process of purchasing an IBM sub-notebook and thought that this could be a *great* setup for mobile/portable packet/RTTY operation. I already (about 18 months ago) constructed an end-fed telescoping halfwave 2m antenna (matched 'J-pole' style, with 300-ohm ribbon) that could be (and is) installed in a rugged Samsonite briefcase. For my next trick, I'll use an aluminum case and possibly stub matching for the antenna(s). Build in gel cells, a charging system, and maybe a small amp (possibly a dual system for data and voice), and I would be ready to roll for anything from fun to events to disasters."

Well, Miles, I appreciated the notes, and information on the software series is at the end of the column. As to the demodulator, there are several little schemes around to simply turn tones into pulses, and the ones that have accompanied the BayCom program may well be the simplest. Figure 1 is one such diagram. This little demodulator uses only one integrated circuit, and may be just what you're looking for. Good luck, and let me hear how you are doing.

Teletype Corp. Manuals

Another E-mail'er is Jim Cooper W2JC, who writes:

"I see in your column that you have been listing folks trying to find decent homes for Teletype Corporation manuals and machines.

"I have quite a supply of original Teletype Corp. manuals for Model 28, 32, 15 and 14 (ha ha!) which I just hate to throw away and I'm sure some historical junkie would die to have them (but how to find somebody like I was 20 years ago?); I actually have an almost complete set of every Teletype Corporation manual, along with many, many duplicates of certain ones. If anyone wants them for nostalgic or historical purposes, an SASE or an E-mail would do—I'm past the point of ever expecting to get any money back on them!

> **" 'I have quite a supply of original Teletype Corp. manuals for Model 28, 32, 15 and 14 which I just hate to throw away and I'm sure some historical junkie would die to have them.' "**

"Also, I still have several types of mechanical teleprinters—Kleinschmidts, M28, etc. I have one Model 28 ASR set that has just about every mod kit Teletype made installed in it! I just hate the thought of it going to the scrap steel pile. Maybe someone reading your column knows of a school club or electronics class that would want it for demo purposes or whatever? Or maybe a deaf person who could use it on TDD?

"Well, if you find the space to mention them I'd appreciate it. If not, no harm. E-mail to w2jc@ritz.mordor.com, Snail mail to P.O. Box 73, Paramus NJ 07653-0073."

Now, is that an offer, or what? Actually, I would take the manuals here, if it weren't for *my* wife laying down the law, and telling me I have to get rid of some of the junque that has been accumulating in the basement for the past 20-plus years. Although, I don't know, you never know when you will need a fresh 6AU6, don't 'cha know! Hopefully, you will be able to handle the requests from the readers. Let me know how it all comes out.

Sound Blaster

Now that we've had an answered question, and an offer that many of you just can't refuse (at least until you tell your wives), how about a question for you all to answer? Here is another note, this one from Bannister Bray AH2CZ, ex-KM6ES, regarding the use of a Sound Blaster card.

"Today I took a much needed solitary lunch break away from the office. During that break I read your column, 'RTTY Loop,' in the April '95 issue of *73 Amateur Radio Today* magazine. Your article inspired this note.

"A number of months ago, while working at home, I overheard a conversation on one of the ham bands that piqued my interest. The topic of discussion was a new software program that used a Sound Blaster computer card to receive and transmit (decode and encode) RTTY, AMTOR, and PACTOR. According to the conversation, the same program and card could also be used as a Digital Signal Processor (DSP) unit for received voice audio that was far superior to the JPS NIR-10.

"Before I had a chance to break into the conversation and learn more about the program, my wife, with her impeccable timing, called me away to do something important for her. When I returned an hour later, the group had disappeared into the woodwork.

"I have heard similar conversations since then about, I assume, the same program/Sound Blaster card combination. All parties said that the combination worked quite well and was a boon to all mankind.

"The question for you is this: Do you know if such a program exists? Does it really work as described above? Who makes it? And how can one get a copy?"

Well, Bannister, after I got your note, I did a search of the various online databases, print, and other references I had, and came up blank. I am quite sure, however, that within 37 milliseconds of the publication of this issue of *73*, I will be hearing from someone who is using just such a scheme. As soon as I hear something, I'll be sure to pass it along to the readership.

FT-757GX Mod

Oh, why not one more question for the summer. Fritz N4JVP relates:

"Several years ago a British ham told me about a mod for the FT-757GX that involved a CW filter from the 101 series. This mod involved disconnecting the MOX switch and used it to switch the CW filter in and out of line while the rig is in the LSB mode. I have unsuccessfully tried to find out more details about this modification and was wondering if you or any of your readers had heard of or tried it. I love my 757 but I would like additional filtering when I run RTTY. Any help would/will be most appreciated."

OK, folks, you're on. Anyone out there who can help Fritz? Let me know.

"RTTY Loop" Software

As suggested above, the 10-volume series of the "RTTY Loop" Software Collection remains available. To obtain a list of programs, just drop me a self-addressed, stamped envelope to the address at the top of this column, or send E-mail to one of the addresses below, and I'll send along the list forthwith. Each disk in the series can be yours by sending a 3.5-inch high density disk, $2 in US funds per disk, and a self-addressed mailer with sufficient postage to me, along with a note telling me which collection you would like.

Of course, I always welcome comments or questions. That should be evident by this month's column. My various E-mail addresses are: CompuServe 75036,2501; Delphi MarcWA3AJR; America Online MarcWA3AJR; Internet MarcWA3AJR@aol.com. Keep writing, electronically or via "snail mail." And stay tuned for next month's "RTTY Loop."

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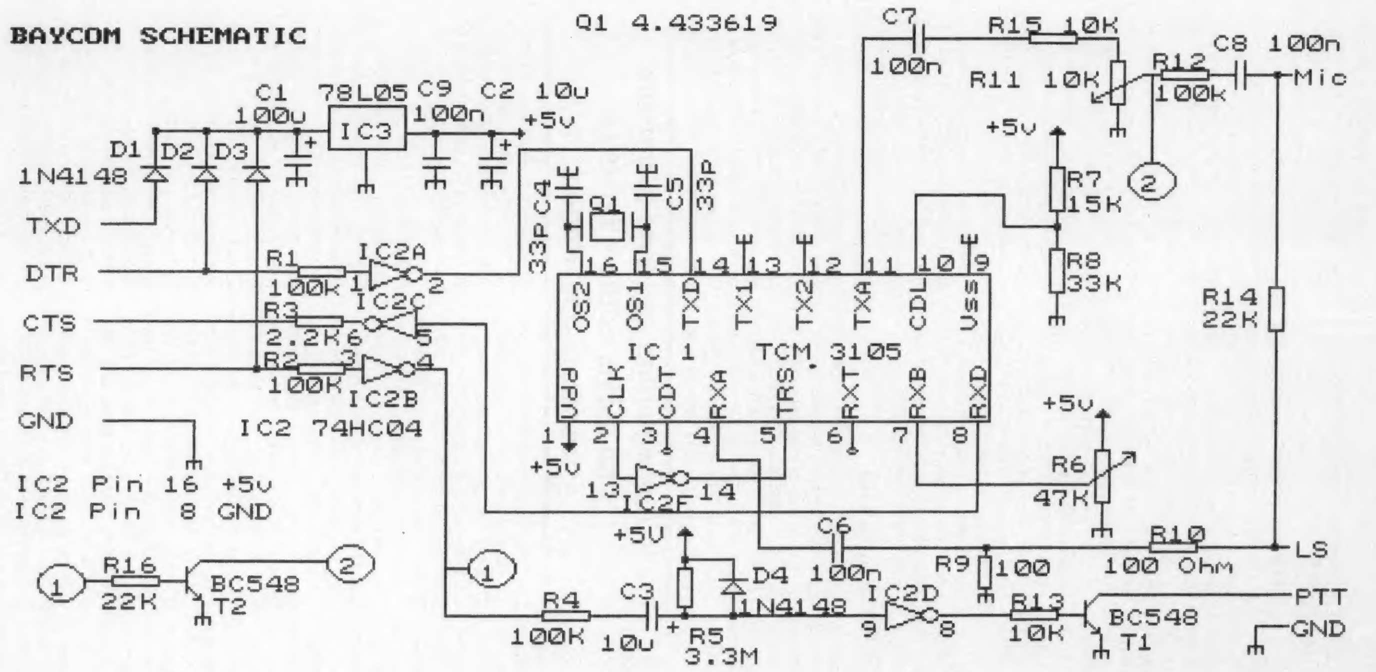
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Figure 1. The schematic for the BayCom RTTY interface.

Number 21 on your Feedback card

ASK KABOOM

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Michael J. Geier KB1UM
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Measuring Up

In this column, I have many times mentioned the use of test equipment, ranging from the old-style analog voltmeter (still a useful item in this digital age) to the oscilloscope. Taking proper measurements is one of the most important skills in electronic troubleshooting, constructing or experimenting. At first thought, the process of taking measurements might seem simple: You just stick the probe on the point you wish to measure and read the results from your instrument. Sometimes it really is that easy, but there can be pitfalls. If you aren't aware of all the implications of the measurement process itself, you may find yourself getting lied to. As in the famous theorems of quantum mechanics, the process of observing can significantly alter the process being observed! So, let's fight for truth, justice and the electronic way by having a look at the procedures involved in taking measurements, and the effects your measuring instrument and technique can have on your work.

Good Ol' Voltage

Probably the most common measurement is of electromotive force, or voltage. Voltage measurements often tell you a great deal. If a voltage is completely missing, that's a big clue to a broken circuit's failure. If it's just low, that too can help you find out why. And, if it's too high, that might indicate a shorted regulator or other power supply problem.

To measure voltage, you need a reference point. Almost always, that point is the common ground of the circuit. These days, the common ground is usually negative with respect to most or all voltages in the circuit. An exception is a circuit which uses dual polarity, such as an op-amp stage. Then, your measured voltage might be positive or negative with respect to ground. It's important to remember that *everything* in a circuit is relative; there is no such thing as absolute voltage, just as there is no such thing as absolute motion or rest in space. But, by picking ground as your reference, you're standing on firm earth with respect to the rest of the circuit. So, you clip your negative lead to the chassis and off you go, right? Well, sometimes. If you're measuring fairly large DC voltages (more than a couple of hundred millivolts or so), that should work fine. Should you pick a ground point too far from the circuit being measured, you may pick up some noise, but it shouldn't be a problem at these voltage levels; compared to the DC voltage itself the noise should be so small that it doesn't introduce significant error.

Welcome To Lilliput

When the voltage you want to measure gets small, though, it can make a big difference. If you're trying to measure 50 millivolts, and you have 20 mV of noise, how valid is your measurement? Not very. In fact, you could get into all kinds of problems by trusting the numbers you get. Luckily, not many situations call for such low-voltage measurements, at least not with a voltmeter. With an oscilloscope, though, it can be a real problem, because you can see small voltages and small signal changes very well, tempting you to try to use the scope in places you would never use a voltmeter. Then, your selection of a close, quiet ground point is much more important.

Carry That Load

Any time you measure something, you have to use a little bit of it up. OK, that's not true of everything there is; you don't need to use any gasoline to float a ball in it and see how high it goes. But, in electrical circuits, you can't get something for nothing. When you measure a voltage, some of its associated current must flow through the measuring instrument. In other words, the voltmeter or scope has a finite resistance which appears to your circuit to be in parallel with the point under test, stealing a small amount of current from it. Is that a problem? Not usually, but sometimes it sure can be. The old analog voltmeters typically had an input impedance of about 20k ohms per volt measured. In other words, if you were measuring 2 volts, the meter appeared to be a 40k-ohm resistor. That sounds pretty high, but is it? On the output of a low-voltage DC power supply, it's meaningless. Heck, at 12 volts, 40k ohms only dissipates 0.3 milliamps, or 3.6 milliwatts of power. That ain't much. But suppose you are measuring the brightness or focus terminal of a CRT circuit with about 1,000 volts on it. Now, your meter appears as 20 megohms (remember, it's 20k ohms per volt). That seems like a lot, but many voltage divider circuits for CRTs are up in the multi-megohm range, thanks to the very high impedance of a picture tube. So, that 20 megohms may pull the voltage down by a significant amount, say 10 or 30 percent. In some circuits it could wipe it out altogether! And, if you happen to be measuring a low-voltage, high-impedance circuit, your voltmeter could swamp that even worse, making it impossible to get any information at all. So, how do you avoid loading down the circuit under test?

> ***"For watching any kind of signals that move, nothing beats an oscilloscope. Period."***

Going Up . . .

The only way out is to make the measuring instrument more sensitive, thus raising the apparent input impedance. One of the first instruments to successfully do that was the VTVM, or vacuum tube volt meter. Basically, it was a regular analog meter, but, between the meter movement and your circuit was an amplifier. The amp used a tube, hence the name of the instrument. By boosting the sensitivity, say, 100 times, the amp could have a very big series resistor on its input, making its input impedance a couple of megohms, rather than 20k ohms. That tremendously reduced the loading effect, making the VTVM a highly useful instrument that didn't load circuits down. At one time, the VTVM was a staple in every TV repair shop. I'm sure plenty of people still use them, although, as far as I know, they haven't been made for many years.

The FET, with its tube-like high input impedance, revolutionized measuring instruments. First of all, the VTVM gave way to the FET voltmeter, which was exactly the same thing except for its solid-state amplifying element. But, without the heat, the FET meter didn't drift so much, and the FET didn't age and lose gain over time. It was a big improvement except for one thing: You could apply just about any voltage to the tube's input without damaging anything, but you'd blow a FET very fast if you abused it. So, servicers had to be more careful.

And Now . . .

These days, digital voltmeters have pretty high input impedances. Like FET meters, though, they are easily blown if too much voltage is pumped into them. And some of them aren't cheap! Still, you can't beat a digital meter for measuring unvarying signals. If you want to know the absolute value of a DC voltage, these things will get you closer to the truth than any analog meter. Also, digital meters have autopolarity. That is, if you hook the meter up backwards, all you get is a minus sign next to the value; the numbers will still be correct. On analog meters, you wind up with a meter pin slamming into the left side, and no useful information. Sometimes, you can even ruin the meter movement.

When voltages move, though, the analog meter is still more useful. Although some digital meters have a few segments of a bargraph-type display under the numbers, most don't. And, even the ones that do have them offer a small number of segments, and thus limited resolution. It does beat trying to follow wildly changing numbers, but it doesn't touch what you can learn from the subtle motions of a real meter movement. In the old days (more than 10 years ago), a good tech could infer a great deal from watching a meter movement's subtle dance. I suspect it is rapidly becoming a lost art, which is a shame. If you are skilled with an analog meter, or want to be, get one now while you still can. Or, at least, don't throw your old one out. I must admit, though, that if I could only have one or the other, I'd probably go with the digital meter, simply due to the convenience and much greater precision and accuracy.

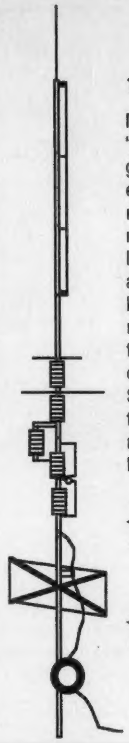
I Can See

For watching any kind of signals that move, nothing beats an oscilloscope. Period. If you've spent years with just a meter, your first experience with a scope will be like taking off a blindfold. Suddenly, you can actually *see* signals going by, with all their little bumps and squiggles. It opens a whole new world of understanding of what's going on in a circuit. Most scopes, though, drift a bit and are not anywhere nearly as accurate in absolute terms. So, don't ditch your meter when you start using a scope. You'll find that you use them both together. In fact, some expensive scopes come with metering functions built in. I especially like the ones with cursors on the screen that let you measure voltage, time differences and other signal parameters right off the face of the scope's display. Once limited to exorbitantly priced laboratory scopes, this capability has come down in price to an affordable point. I've seen scopes in the $1,500 range that have it. It's important to recognize, though, that the basic accuracy of the numerical readout may or may not be any better than that of the scope itself, depending upon the design.

Pitfalls

When you measure voltages with a scope, you see them change over time. That's usually good, but it can be a problem, too. Let's say you want to know the voltage of a power supply's output. Your voltmeter says 13 volts, but your scope displays 12.7 to 13.5 volts, because the supply has 800 mV of ripple on it. So, what's the true voltage? There isn't one! At one moment, the voltage may be 12.7 and at the next, it may be 13.5. In order to use this information, you need to know the reason for your measurement. If it's just to get an average voltage, I'd trust the voltmeter and go with 13. If, though, you need to protect a circuit from anything more than 13 volts, it pays to recognize that the supply may instantaneously rise to 13.5 from moment to moment, and do something about it.

Well, there's lots more to measurement technique, but I'm running out of room for this month. Next time, we'll continue this topic. Until then, 73 from KB1UM.



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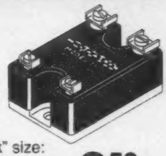

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A large section of my classroom is devoted to geography reference books and materials, maps, globes, atlases, and letters and stamp albums from unusual or exotic locations. Very often the radio manufacturers give away classroom maps if you request them on school stationery. With the world changing as quickly as it does, it's important that maps and geography resources be constantly updated in the classroom. The reasons for the updating can make for a great discussion and lesson.

Sources

The following list of resources is worth investigating. Some are free, and they will all make good additions to your class library and reference center.

1. World Game Institute: A nonprofit, nonpartisan global research and education organization which utilizes a creative, experiential approach to education. It provides computer software, a World View Map series, World Game Workshops, and publishes statistical data from the United Nations, the World Bank, the World Resources Institute, and other sources. For more information on what is available contact: World Game Institute, 3215 Race Street, Philadelphia, PA 19104; (800) 220-4263.

2. *How to Help Children Become Geographically Literate:* The NCGE (National Council for Geography Education) has published the booklet *How to Help Children Become Geographically Literate.* It helps parents and teachers learn how to teach basic geography concepts to children. Single copies are free, 50 copies cost $7.50, and 100 copies cost $12. For information write: NCGE, 16A Leonard Hall, Indiana University of Pennsylvania, Indiana, PA 15705.

3. *WorldWise* Newspaper: *WorldWise* is a monthly thematic world affairs newspaper for grades 8-12. Each issue focuses on one timely topic and features a center spread that puts the topic in clear historical and geographical context. The cost is 75 cents per student per month, or $6.15 per student per year. For more information contact: *WorldWise,* Dept. EF, 4 West Wheelock Street, Hanover, NH 03755.

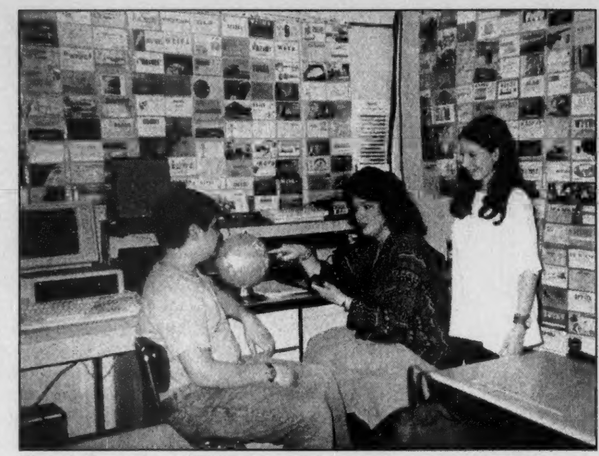

Photo A. Carole Perry WB2MGP uses globes to make a point with eighth-graders Jordan KB2PYS and Renée KB2QMR.

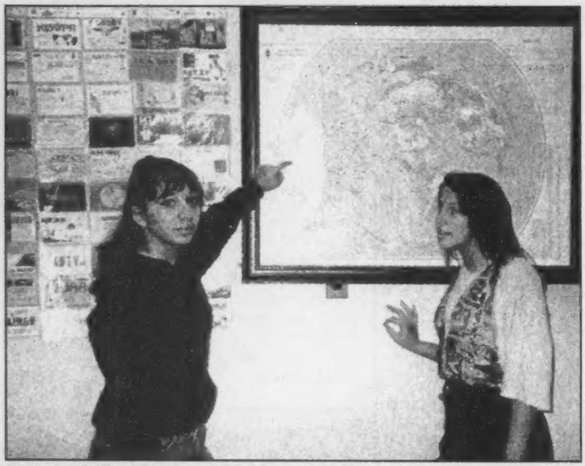

Photo B. Eighth-grader Rose KB2QMK points out a location on the map to eighth-grader Lisa.

4. ZPG's New Elementary Kit: "The Counting on People: Elementary Population and Environmental Activities" kit is designed for teachers of grades one through six. The kit contains 150 spiral-bound pages of fun elementary population activities and student worksheets which can be easily reproduced. The cost is $19.95 plus $1.50 for shipping and handling from: Zero Population Growth, 1400 16th Street, NW Suite 320, Washington, D.C. 20036.

5. Poster Education: The Global Poster Corporation has produced over 20 posters with the Five Themes of Geography in mind. A detailed ready-to-use set of lesson plans is enclosed with each poster. For a brochure describing the posters contact: Poster Education, 5 Howland Road, P.O. Box 8774, Asheville, North Carolina 28814; (704) 253-4995.

6. Free ERIC *Digest:* The Clearinghouse for Social Studies and Social Science Education is offering free *Digest* copies and a packet of basic information on the ERIC system in general and the ERIC Clearinghouse for Social Studies/Social Science Education specifically. For questions or to request materials contact: Vicki J. Schlene, (800) 266-3815; vschlene @indiana.edu.

7. *Alliance Yellow Pages:* Marycarole Deane, a California TC, has compiled a 12-page directory of publications and materials which have been produced under the auspices of the various Geography Alliances. Included are lesson plan collections, thematic teaching ideas, software, bumper stickers and a T-shirt. A copy of the *Alliance Yellow Pages* can be received for free by contacting: NYGA, Department of Geology & Geography, Hunter College-CUNY, 695 Park Avenue, New York, New York 10021.

8. *Social Studies Standards:* The National Council for the Social Studies has published *Expectations of Excellence: Curriculum Standards for Social Studies.* This document sets down the framework for a K-12 social studies program which can be integrated with the other national standards in geography, economics, civics, and government. Performance expectations are also included. The 180-page book can be purchased for $15 for non-members and $12.75 for NCSS members, plus $2.50 for shipping. To receive a copy write to: Whitehurst & Clark, 100 Newfield Avenue, Raritan Center, Edison, New Jersey 08837; (800)683-0812.

9. Geographic Inquiry into Global Issues (GIGI): Encyclopedia Britanica Educational Corp. has developed a set of secondary instructional materials that give teachers an alternative from standard geography texts through the use of a CD-ROM and three videodiscs. For more information on GIGI, contact: James Dunn, P.O. Box 6115, Boulder, Colorado 80306-6115; (303) 440-7505.

If you use any of these materials in a successful lesson in conjunction with your ham radio classes, please let me know so we can share your experiences with other teachers and instructors.

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NEVER SAY DIE

Continued from page 4

Arrogant Scientists

Working in the cold fusion field has brought me into contact with both open- and closed-minded scientists. I don't mind if a scientist, or anyone else for that matter, disagrees with others about something. What annoys me is when someone strongly disagrees about something that they haven't bothered to find out about.

"Well," they say, "everyone knows" such and such. Oh, baloney. Sure, we know quite a lot about things we can see and feel. When it gets to the micro and macro we know less. Okay, matter is made of molecules. Molecules are made of atoms. Atoms are made of electrons, protons, neutrons and stuff. Yeah, and what are they made of? Well, quarks. And they're made of subquarks. And then what? We have no idea of how many more layers this goes . . . levels of abstraction. If they're some kind of energy, what kind?

On the macro end cosmologists are theorizing all over the place. The Big Bang comes and goes in popularity as astronomers and astrophysicists come up with new data which requires retheorizing to explain the new data. So they argue over an expanding universe that isn't expanding into anything. They theorize about parallel universes, wormholes and super strings. Then some astronomers screw it all up by discovering that our whole end of the universe seems to be moving off to the left at 435 miles per second, attracted by no one has a clue what, or perhaps repelled. Liberals should like that.

If you've been reading *Newsweek* and *Time,* you know that astronomers and cosmologists are battling each other over a welter of contradicting theories. Cover stories, no less. Every time a group of astronomers comes up with new information, it seems to blow all previous theories into hyperspace. Have you been reading about the Great Wall? The Great Attractor? The missing Dark Matter? Don't wait for the scientists to agree before plunging into this mess because you aren't likely to live that long.

Yes, of course I can recommend a couple of good books. One of the best and most readable is *Exploring the Physics of the Unknown Universe* by Milo Wolff. It's $15 in paperback, so look for it. Milo is a good friend and one of my scientific advisors for *"Cold Fusion."* Also in paperback, at $14, is *The Big Bang Never Happened* by Eric Lerner.

I've a news flash for you: Scientists are no smarter than most of the rest of us. They don't even know much more about most things outside their special niche than we do. The major difference is that they have taken the time to learn a whole lot about one thing. They've become experts on it. Well, you'll be surprised at how little effort it takes to catch up with most of these specialists. When I tackled ham teletype I started from ground zero. Within a year I was writing articles and then I wrote the first book on the subject and had a regular column on it in *CQ.* And I didn't do anything that anyone else with the guts to tackle the subject couldn't have done.

When microcomputers came along I decided it was time to learn about them. When I discovered that there were no decent books or magazines to help me, I started *Byte.* I knew that this incredible new development would spawn a need for information. I was right. When I started it I had to hire an editor who knew about computers. A year later I'd learned enough about computers to edit my next magazine in the field, and to be out lecturing. That wasn't a matter of any great brilliance on my part, just the result of a lot of hard work.

The compact disc got me involved with digital recording, so I had to start fresh in that field. No, I haven't been watching Geraldo, Oprah, Donahue and such. No ball games. No quiz shows. Darned few sitcoms. But I have read a bunch of books and attended conferences. It's your option whether you want to be an expert in something or a dummy. None of this stuff is very difficult to understand if you bother to read. Well, most of it. I have to admit to being over my head on particle physics, where there are over 200 particles flying around. But I'm working at it, so maybe by next year I'll at least be able to ask the experts questions.

Amateur radio is in desperate need of some pioneers. Here we are, stuck in the 1960s with our technology. We should be using digital voice and developing our own data compacting algorithms. We should be zapping data through our ham satellites at 28.8 kB, at the least. Instead we are still fighting in pileups when someone comes on from a rare country. Or not rare, if band conditions are lousy. Heck, I've seen pileups just for Venezuela when DXers get really desperate.

With the Internet looming as an alternative to amateur radio, we'd better get cracking. We have the satellite bands. We even have some satellites. What we don't have is the technology. We got started with packet around 20 years ago, and have been progressing at a snail's pace ever since. We pioneered sideband 40 years ago and haven't budged an inch since. We got busy with repeaters 25 years ago and we've hardly seen a smidgen of progress since. In 1970 I had a repeater on a local mountain which repeated on either 10m or 6m as well as 2m. How many do we have like that 25 years later? I'ze regusted.

Neither my mail nor my reading of a stack of ham club newsletters every month give me any cause for hope. How's about getting off your duff? I want to start seeing some articles showing progress. And no, you're not too old to start something new. I'm 73 and busy learning. Doc Patterson, the chap who got the first cold fusion patent, is my age. When a nine-year-old girl can get an Extra Class ticket and a 73-year-old invent circles around some of the world's top laboratories, what's your excuse?

If you can't provide some articles for me to publish to help jolt us into action, at least review some books we can read that may help us get started.

It's Impossible

When John Campbell W2ZGU, the editor of *Analog,* told me about the Heironymous Machine I frankly didn't believe him. It was just too preposterous. It violated everything I'd been taught. It violated my experience. It was obviously completely impossible. Then came Henry Gross' Wishing Machine, which was even more absurd. John was an amazing genius and he was into everything. A lunch with him was like riding an intellectual roller coaster, going into electrochemistry for a few minutes, then into nuclear physics, psychology, sociology, and so on. But when he came up with stuff that was patently absurd, even though the machines had been patented, I rolled my eyes.

I had the same reaction when pyramids came along. Little paper pyramids can sharpen razor blades? Sure. And mummify dead animals? Har-de-har. But what if little paper pyramids really can sharpen razor blades and there are photomicrographs to prove it? What do you do when something is clearly impossible, yet it happens?

Well, G. Harry Stine has fiendishly come up with seven machines you can build for yourself and test. They're all simple to make, and the really irritating part is that every blessed one of them works. None of them should or even could possibly work. The nice part of it is that they all will work, whether you believe they will or not. Even worse, they'll work with the double-blind scientific test too. You're going to have to face the fact that they all do work and that we haven't a scientific clue as to why.

The scientific approach to all this is to pooh-pooh it and not bother to test any of them since there's no known way they can possibly work. That's the approach some old-line scientists have used with cold fusion, and never mind the dozens of labs around the world generating completely unexplainable large quantities of heat. It isn't possible, therefore there's no reason to check it out.

Now, if you'd like to upset yourself and prove the completely impossible is real, invest in Stine's book. It's 207 pages in paperback and is available from Top of the Mountain Publishing, Box 2244, Pinellas Park FL 34664. Send $18 (postpaid) for Stine's *Amazing and Wonderful Mind Machines You Can Build.*

The book shows the tube version of the Heironymous Machine, as well as a transistorized version, and even a new IC model that you can assemble in a few minutes. This gadget will tell you what metals are in anything you put by the input coil, and what percentages of each metal. This, of course is completely impossible. But it gets worse. You detect the presence of metals by feeling a plastic or glass plate which is over the output coil. Yes, this fool thing will work whether you believe it or not. It'll work for most people, but not all. Around 80%. And for those for whom it works, it works repeatably, even when the operator has no clue as to what is being tested.

It gets worse. The damned thing keeps right on working with the power turned off. Working repeatably. Now explain *that* to someone. But, alas, it gets even worse. It turns out you can replace that IC circuit with an inked drawing of the circuit, connected to the input and output coils with thread instead of wire, and it keeps right on working, like the Energizer Bunny. You do have to re-ink the battery drawing now and then to keep it running. Apparently the battery drawing runs out of juice when the ink begins to fade.

All this is pure hoakum, right? It's so foolish you'd never try to build even the simple machines that Stine describes in detail. It's not worth reading about. Okay, fine, don't look through Galileo's telescope. Don't hang a couple nickels in a potassium carbonate solution and see if excess heat is generated. Laugh and jeer at gullible old Wayne. Obviously I'm losing what's left of my marbles. Well, that's what a bunch of readers were saying when I started pushing 2m FM and repeaters back in the 1960s. They said it again when I pushed microcomputers in 1975. I sure must have started out with one big bag of marbles to lose so many and still keep going. So make poor old Wayne look dumb. Get the book, build the gadgets Stine describes, and prove they positively won't work by testing them yourself and on a bunch of friends.

My grandfather showed me how to dowse with a beech tree branch when I was about seven years old. It worked for both of us. Dowsing works just fine for people all around the world. They dowse for water, oil, minerals, underground pipes, and so on. Nobody has a clue as to how or why dowsing works, so the pathological skeptics just refuse to accept it. To me, when something unexplainable happens, that's the time to start finding out why, not the time to say it's all a fake, never happened, and ignore it. We've lost a lot of valuable knowledge and experience via pathological skeptic pressure.

Just look at what the head of the DOE has been able to do to the American cold fusion research effort. He almost single-handedly has put America way behind many other countries in this new field; Japan in particular. The cold fusion pioneers in India and Italy are heros, here they were ridiculed and humiliated. Well, that's what happens when our government gets involved with just about anything. The government seems able to screw up everything it does.

Virtually every major contributor to health care cost escalation has been caused by government meddling. Ditto our school system, which is the worst in the developed world, and making us less and less competitive with the far better educated people in other countries. When Bulgarian school kids easily outperform ours it's almost time to do something about getting the government out of the education business. I keep harping on that, don't I? Well, you aren't *doing* anything.

Now send for that book and stop procrastinating. And renew your subscription to *73* while you're at it. Heck, subscribe to *Radio Fun* too, it's only $35 for the combo (every radio and TV program ends with a commercial, right?).

Committing Slow Suicide

Every now and then a reader sends me a newspaper or magazine article claiming that the evidence that magnetic fields can make people sick is exaggerated. Just as the tobacco companies spent big money to buy scientists to claim that they hadn't yet seen any conclusive evidence connecting smoking and cancer, the power companies are buying as many scientists as they can to keep from being forced to re-route power lines away from schools and to move distribution transformers away from houses.

If you've been reading my stuff for long you know that I'm not a Chicken Little. I do my homework carefully before I go out on a limb and report what I've found to you. You've never seen me getting all het up over acid rain, the nuclear winter, the greenhouse effect, Alar, and all those other similar "scientific" ecoscares.

For those who have been brainwashed by the media and aren't sure that old Wayne is on firm ground, I've cited several excellent books on the subject. Well, there's another one just out. Stop being chintzy and spend the 10 bucks. Look for *The EMF Book* by Mark Pinsky; Warner Books 67004-9.

For several years I've had a list of the scientific papers reporting on research in the field posted on the *73* BBS. Hundreds of papers. On several occasions this bibliography has come in handy for groups fighting power companies who have wanted to string high tension wires near their homes or schools, helping them win. When the BBS activity fell off, with most readers turning to the Internet for entertainment, I closed down the BBS. If there's enough interest we might post the list on the Internet. It runs to around 80 pages, so it's not trivial.

The Meaning For Hams

If you are in an area where you are in much more than 1 miligauss of magnetic field you are adding to your risks for any number of illnesses. These fields have much more of an effect on rapidly growing things, like kids and babies during pregnancy. And remember, the changes in the DNA which these microcurrents cause are not going to be in any way beneficial. When you damage DNA you are causing long-term Forrest Gump-type problems. Ditto when you screw with your immune system.

Your body is generating all kinds of stuff that can cause trouble when your immune system slacks off. Millions of tiny cancers, and so on, are handled by your immune system. Unless it gets damaged, in which case all kinds of awful things can result. Micromagnetic fields interfere with the communication between your cells, interfering with their normal function. This probably explains why hams have such an elevated cancer risk compared to the average couch potato.

You should get a miligaussmeter and check out the fields in your shack. Your transceiver may not be all that bad, but if you're running a linear, you're probably going to find that you have to move it several feet from where you've been using it to get the field down to a safe level.

The worst problems aren't from steady fields, but from rapidly changing fields. This is suspected to be the reason there are so many illnesses reported near power company substations, where huge transients are generated regularly. If you are a CW operator and are running a linear within a few feet of your body, this could explain why you have gradually turned into a mental basket case and have been writing really stupid letters to me.

Sure, I joke about the surprising number of Extra Class hams who are certifiable nut cases, but there's a lot of data suggesting that I may not be exaggerating as much as I pretend. The Extra Class hams I know who are the sanest are those who cheated to get their tickets and who never operate CW. Hmmm, perhaps a good ham lawyer could bring a class action suit against the FCC for forcing hams to drive themselves crazy with the code?

But, in addition to screwing up the brain, if CW is also causing cancers, why take unnecessary chances? Move the linear. I have no problem with hams enjoying CW. It's fun. But that's no reason to slowly accelerate the receipt of your Silent Key certificate. We all have enough problems keeping our immune systems in good shape as it is. It gets weakened when you get too tired, or if you have a serious trauma. This explains why spouses often die shortly after their husband or wife dies. The traumatic shock lowers the immune system so that any passing germ or virus can grab hold and do them in. For instance, about 33 hours after a fight with your wife you can expect a cold or some kind of seeming accident.

We're very fortunate that one of the world's leading researchers in the EMF field is Dr. Ross Adey K6UI. I've published his testimony before Congress in *73*. He testified on the dangers of cellular telephones, police radar units, and magnetic fields around the home.

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If you or your family are still using electric blankets, you're asking for major problems. Most of the other home electronic equipment is fairly benign, or is used for only a short time. But if you've seen some of the photos of guys who lost their chins to cancer due to using electric shavers, you'd better understand what a few added miligauss applied regularly can do.

The most vulnerable are youngsters, but extended exposure can do in even the nastiest of old-timers.

Making Money From EMFs

You can get some darned good gaussmeters now for well under $100. An enterprising ham or ham club could make a good buck and do a fabulous public service by gaussing out homes and businesses for people. And every member's ham shack. Buy a meter and then charge $20 or so to check customers for dangerous magnetic fields. How bad is it around their microwave? Around their computer? Their projection TV?

With classified ads in the local papers, want advertisers, and shoppers, a club could be kept busy gaussing out the town. At the least it could be a nice spare-time business for someone. Print up a nice-looking certificate you can issue showing the home or business to be free of dangerous magnetic fields.

As you find and eliminate magnetic fields you can send releases on your work to the media and thus get more publicity for your work, and for the ham club. It'll be nice to be seen as something other than a bunch of technonerds with those ugly big radio towers who cause interference to TV and hi-fi systems. And who knows, the publicity could get some kids to eschew TV and come to a club meeting so your old-timers can make them wish they'd never come.

Memory Loss

A reader bought a brand-new rig, one with a bunch of memories. But he found that when he turned off the rig the memories evaporated. That didn't seem right to him, so he went back to the store where he bought it and asked. This was a branch of a national ham chain, mind you. The salesman said oh yes, that's the way these rigs work. He then demonstrated this with the one on display. Sure enough, the memories all blew away when the power switch was turned off.

Now, being one of the small percentage of hams who had managed to graduate from college with some reading comprehension, our hero did the unbelievable—he consulted the instruction book. Yep, the memories were supposed to survive minor emergencies such as turning off the big switch. The power source for the memories was a small lithium battery buried deep inside the monster. Very deep.

Our hero, only semi-daunted by this news, got out his tools and started the excavation. What he eventually found at the bottom of the pit was a dead lithium battery. Would you believe that the manufacturer had soldered the thing in? After a short memorial service, more filled with oaths than eulogies, our hero carefully soldered in a new lithium battery, making sure not to fry the battery in the process—which may be what happened to the factory-installed battery—and refilled the excavation. Yes, of course the rig worked just fine, complete with more permanently memorized frequency settings.

So, I suggest, if you buy a rig with Alzheimer's, take it back to the store and don't fall for any baloney. Let them disinter and resurrect the deceased battery.

Of course, if this whole memory business is more than you can deal with, then never mind.

Fighting Senility

This is a subject which should be near and dear to at least 70% of the active hams. In case you don't read the *Wall Street Journal,* you missed an interesting article on warding off senility. Luckily reader N8PWY is a much better person than you and keeps his Uncle Wayne's need for interesting clippings in mind. Wayne does not read any newspapers. No time. So it's up to you to check through your papers and clip out and send me anything having to do with UFOs, ham radio, medical facts, scuba diving, and so on. I haven't made any secret of what interests me, so keep some scissors handy.

Anyway, it turns out that not only should you be out there walking briskly for a couple of miles a day, getting some actual sun rays into your eyeballs, taking your vitamins, and stuff like that, your brain also works on the use-it-or-lose-it basis. Once you start vegetating, your brain is going to turn into a turnip. So stop beefing about my editorials not all being about amateur radio. Start getting some of the books I recommend. Get some others too. And if you find any that are real interesting, let me know so I can buy them too. I may suffer from a lot of old-age miseries, but turning senile isn't likely to be one of them. I read every minute I can spare. I jog a couple miles every day. I take my vitamins. I eat healthily. The result is that, despite some recent massive emotional traumas caused by crooked employees, I'm going strong.

This is one of the reasons that people who retire and take it easy die so fast. Getting out there for golf may give you exercise, but it isn't going to keep your brain from turning into pudding. It isn't too late to get some books and start learning. Or maybe taking on some kids for elmering. Or even some doddering old-timers who could use the company ham radio offers. You sure don't get lonely when you have a ham rig at hand, and loneliness is one of the major senior complaints. ■

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the April issue, we should receive it by January 31. Provide a clear, concise summary of the essential details about your Special Event.

JUNE 3

KNOXVILLE, TN The Radio Amateur Club of Knoxville will hold its 29th annual Hamfest/Computer Fair at the Jacobs Bldg. in Chillowee Park, from 8 AM-3 PM. Setup Fri. eve, and before the doors open on Sat. VE Exams. Talk-in on 147.30 and 224.50. Call *Angela Crigger N4RPR, (615) 694-9071.*

JUNE 4

BUTLER, PA The 41st Breezeshooters' Hamfest will be held 8 AM-4 PM on the Butler Farm Show grounds. Talk-in on 147.96/.36. To reserve Flea Market tables, send check for $15 per table and an SASE to *Rey Whanger W3BIS, 5530 Cove Run Rd., Cheswick PA 15024-9451.* For General info call the *Breezeshooters' Hotline at (412) 828-3694.*

MANCHESTER, MI The 18th annual Chelsea Swap 'N Shop will be held by the Chelsea ARC, Inc. at the Chelsea Fairgrounds, starting at 8 AM. Flea Market Setup at 6 AM. Talk-in on 146.980 Chelsea Rptr. For info, mail your request with an SASE to *Chelsea ARC, Inc., P.O. Box 325, Manchester MI 48158;* or call *Gary R. Widmayer, (313) 428-9398.*

MANASSAS, VA The Ole Virginia Hams ARC will sponsor the Manassas Hamfest/Computer Show at the Prince William County Fairgrounds, starting at 8 AM. Tailgaters 7 AM. Talk-in on 146.37/.97 and 223.06/224.66. Commercial vendors call *Joe K4FPT at (703) 257-9719.* For general info, call *Mary Lou KB4EFP at (703) 369-2877.*

JUNE 10

WINSTON-SALEM, NC The Winston-Salem Hamfest/Computer Fair will be held at Dixie Classic Fairgrounds, 8 AM-3 PM, by the Forsyth ARC, Inc. VE Exams by pre-reg. only. Talk-in on 146.04/.64. Send SASE to *Bill Patterson KD4RGB, Winston-Salem Hamfest, P.O. Box 11361, Winston-Salem NC 27116. Tel. (910) 723-7388 (24 hrs.).*

JUNE 11

COVINGTON, KY The Northern Kentucky ARC will hold "Ham-O-Rama '95"at the Erlanger KY Lions' Park (on Sunset Ave.) starting at 8 AM. Flea Market set-up at 6 AM. Talk-in on 147.255+ or 147.375+ Rptrs. Contact *KC4FET, c/o NKARC, P.O. Box 1062, Covington KY 41012. Tel. (606) 341-1213; FAX (606) 384-4002.*

HANOVER, PA The Pleasant Hill Computer/Hamfest will be hosted at Pleasant Hill Fire Co., (RTE 94, 5 mi. So of Hanover) by the Hanover Area Hamming Assn.. Time: 8 AM-???. Talk-in on 146.895-. Contact *Rodger Gibson N3ICJ, P.O. Box 820, Hanover PA 17331; Tel. (410) 239-8451.* To inquire about VE Exams, call *Bill NZ3J, (717) 359-7090.* Testing will be at 8 AM.

QUEENS, NY The Hall of Science ARC Hamfest will be held at the NY Hall of Science parking lot, Flushing Meadow Park, 47-01 111th St. Setup at 7:30 AM. Buyers admitted at 9 AM. Talk-in on 444.200 WB2ZZO Rptr., 146.52 simplex. For info, call evenings only, *Charles Becker WA2JUJ, (516) 694-3955* or *Arnie Schiffman WB2YXB, (718) 343-0172.*

WILLOW SPRINGS, IL The Six Meter Club of Chicago, Inc., will hold their 38th annual Hamfest at Santa Fe Park, 91st and Wolf Rd., starting at 6 AM. For advance tickets, contact *Mike Corbett K9ENZ, 606 South Fenton Ave., Romeoville IL 60441.* Dealers, for Pavilion reservations contact *Joseph Gutwein WA9RIJ, 7109 Blackburn Ave., Downers Grove IL 60516; Tel. (708) 963-4922.* Talk-in K9ONA 146.52, or K9ONA/R 146.37/.97 (107.2 Hz).

WINFIELD, PA The Central Pennsylvania Ham and Computerfest will be sponsored by the Milton ARC at the Union Township Fire Co. Carnival Grounds. The event starts at 8 AM. Talk-in on 146.37/.97, 147.78/.18, 146.52. For info, call *Dave Welker AA3BO, days at (717) 286-0787; eves., (717) 286-0787,* or write *S.V.A.R.C., P.O. Box 73, Hummels Wharf PA 17831-0073.*

JUNE 15-18

RED DEER, ALBERTA, CANADA The Central Alberta Radio League will host their 25th Anniversary Picnic and Hamfest at the Burbank Campsite, located approx. 8 km. NE of Red Deer, Alberta. Talk-in on 147.150+ MHz, or 146.520 simplex. Contact *Bob VE6BLD, Box 1091, Lancombe Alberta T0C 1S0, Canada. Tel. (403) 782-3438. Packet VE6BLD @ VE6RDR.AB.CAN.*

JUNE 16-17

ST. PAUL, MN "Electronics Fair '95" will be held at the Aldrich Arena, 1850 White Bear Ave., Maplewood MN. This is an Amateur Radio, Hobby Electronics, and Computer Swap & Show. Times: Fri., Flea Market 6 PM-9:30 PM; Exhibits 6 PM-10 PM. Sat., Flea Market, 6 AM-3:30 PM; Exhibits, 8 AM-3:30 PM. Electricity not available in flea market. For commercial booth and club exhibit info, contact *Electronics Fair, P.O. Box 26331, St. Paul MN 55126. Tel. (612)*

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653-9999. Computer users, call *HAM-LINK, (612) 426-0000 (300-28,800 baud)* and *(612) 426-1010 (300—14,400).*

JUNE 17

BANGOR, ME The Pine State ARC will hold the "Bangor Hamfest" 0800–1300 hrs at Herman Elementary School. Talk-in on 146.34/.94 and 146.52 simplex. There are 3 campgrounds and many motels within 5 miles of the Hamfest. Contact *Roger W. Dole, RR #2 Box 730, Bangor ME 04401; Tel. (207) 848-3846.*

DUNELLEN, NJ Raritan Valley RC "95 Hamfest" will be held at Columbia Park, 7 AM-2 PM. Talk-in on 146.625 rptr, 146.520 simplex. Contact *John Manna WA2F, (908) 722-9045,* or *Bob Pearson WB2CVL, (908) 846-2056 before 8 PM.*

LANCASTER, PA A Computer, Electronics Show, and Hamfest will be held at Centerville Jr. H.S., 865 Centerville Rd, 9 AM-2 PM, by the Red Rose Repeater Assn. Talk-in on 147.015(+) and 449.575(–). Vendors, contact *Mark Walton, (717) 560-2321; FAX (717) 560-2820.*

MIDLAND, MI The Midland ARC will hold their 20th annual Hamfest at the Midland Nat'l. Guard Armory 8 AM-1 PM. VE Exams. New and used amateur electronics and equipment. Talk-in on 147.00(+) Midland. Contact *MARC Hamfest, P.O. Box 1049, Midland MI 48641.* Please SASE, or call *(517) 832-3053 eves. and wknds.*

JUNE 18

CAMBRIDGE, MA A Flea Market will be held 9 AM-2 PM at Albany and Main Sts., by the MIT Radio Soc. and the Harvard Wireless Club. For reservations/info, call *(617) 253-3776.* Mail advance reservations before June 5th to *W1GSL, P.O. Box 397082 MIT BR., Cambridge MA 02139-7082.* Talk-in on 146.52 and 449.725/444.725 pl 2A W1XM/R.

MUNSTER, IN The Lake County ARC will hold their 23rd Annual Dad's Day Hamfest at the Lake County Fairgrounds in Crown Point IN. Setup at 6 AM, open to the public at 8 AM. VE Exams at 9 AM. Talk-in on 147.000(+). Contact *John Gianotti KF9GW, 1513 Camellia Dr., Munster IN 46321. Tel. (219) 922-1065.*

JUNE 18-25

CERRITOS, CA Yaesu U.S.A. will sponsor "DX-Caribe Cruise '95", the second in a series of Amateur Radio theme cruises. Grid Square Itinerary: FK-42 Aruba, June 16, 17, 18; FK-53, 63, 74, 84, 85, 95 Dominca, June 19/June 20; FK-95, 94, 93 Barbados, June 21; GK-03, FK-93 Martinique, June 22. For cruise info, contact *Landry & Kling, Inc., 1390 South Dixie Highway, Suite 1207, Coral Gables FL 33146. Tel. (800) 448-9002.* Inquiries from outside the US may be directed via FAX to *Landry & Kling, (305) 661-0977.* Operations will be mobile from Dolphin Cruise Line's S.S. Ocean Breeze, and DXpedition style from beach locations.

JULY 4

HARRISBURG, PA The Harrisburg RAC will hold a Hamfest at Bressler Picnic Grounds 8 AM-1 PM. Setup and tailgating at 6 AM. NO overnight camping. All vendors must collect PA sales tax. Talk-in on 146.76/.52. For table reservations, contact *Tom Hale WU3X, Box 418, Halifax PA 17032;* or call *(717) 232-6087* for info.

JULY 27-30

COLORADO SPRINGS, CO The Central States VHF Soc. will hold its annual conference July 27-30. Papers for inclusion in the conference proceedings, or for presentation at the conference are hereby solicited. Deadline for papers is early May, 1995. For info, please contact *Hal Bergeson W0MXY, Program Chairman, 309 East Vermijo Ave., Colorado Springs CO 80903. Tel. (719) 471-0238.*

SPECIAL EVENT STATIONS

JUNE 2-3

BATTLE CREEK, MI Southern Michigan ARS will operate W8DF June 2nd 2100Z-June 3rd 2100Z, to commemorate "Urbandale Area Homecoming." W8DF will operate CW and SSB in the lower 25 kHz of the General 10-80 meter bands, and the Novice subbands. For a Special Event Card, send QSL to *W8DF, P.O. Box 934, Battle Creek MI 49016.*

JUNE 2-4

DES ARC, AR The North Central Arkansas ARS will sponsor Station KB5DBI June 2 1800Z-June 3 0200Z, and June 3 1600Z-June 4 0200Z, to commemorate Steam Boat Days. Operation will be in the General portions of 15, 20 or 40 meters, and the Novice portion of 10 meters, if conditions permit. For a QSL, send a 9" x 12" SASE (or send $1.00 and we will provide the envelope and postage) to *NCAARS, P.O. Box 911, Judsonia AR 72081,* or to *KB5DBI at the call book address.*

HAINES FALLS, NY The Long Island Mobile ARC's Junior Operators Committee will operate N2LSK from their QRP camping weekend at North Lake Camp Grounds in Greene County. Operation will be on or near 7.040, 3.560 CW and 7.225 phone. For QSL, send SASE to *Robert Todaro N2JIX, 2218 E. 73rd St., Brooklyn NY 11234.*

NORTH OLMSTED, OH The West Park Radiops ARC will operate W8VM on Satellite and HF June 3 0000Z-June 4 1600Z, in conjunction with All Scout Weekend. Operation will take place on satellites RS-10/11, RS-12, and RS-15, as the orbits and modes permit. When satellites are not available, W8VM may be found on 3.880, 7.280, and 14.280 MHz. CW operation will be 30 kHz up into the General portion of the CW bands, and in the Novice CW bands. QSL with regular SASE for a card, or 9" x 12" envelope for a special certifi-

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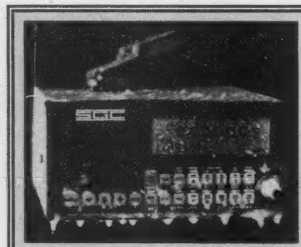

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The SG2000 HF transceiver is type accepted for commercial and marine service made with traditional U.S. commercial radio quality (and of course it can be used on the ham bands also). While the Japanese radios have 2 final transistors that strain to put out 100 watts on the low bands and only 75-85 watts on ten meters, the SG2000 has 4 large transistors that loaf along at 150 watts on ALL THE BANDS INCLUDING 10 METERS! Some of the SG2000 features are: 1) A control head remotable (no special kit necessary) up to 150' away from the rig, perfect for automobiles and boats. Up to 8 heads can be utilized and used as intercoms also. 2) The largest display of any HF transceiver. 3) 644 pre-programmed memories and 100 user programmable memories. 4) operable from -50F (-45C) to 185F (+85C). You want quality right? Here is what EVERY SG2000 must endure before they're shipped from the factory: 1) They're factory aligned, 2) EVERY SG2000 is keyed down at full power (CW 150 Watts) into an open antenna for about 10 seconds, then connected to a shorted antenna and keyed down for an additional 10 seconds. 3) EVERY SG2000 is put in the "BURN-IN" rack and keyed down for 24 hours non-stop at full power CW. Don't try that with the foreign radios. 4) EVERY SG2000 is then re-checked for alignment and put in the "TORTURE RACK" where they are keyed on and off every 10 seconds for 24 hours. 5) The SG2000 is then re-evaluated and all control functions are verified to ensure that the microprocessor is up to spec. THEN AND ONLY THEN IS THE SG2000 ALLOWED TO LEAVE THE FACTORY.

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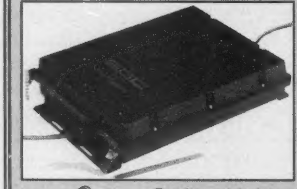

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cate. Mail to *W8VM, 513 Kenilworth Rd., Bay Village OH 44140.*

TORONTO, CANADA The Boy Scouts of Canada, Greater Toronto Region, will operate VE3TXU from Humber West Area Competition Camp. Operation will be Sat. June 3rd, 1300 UTC-1600 UTC, 1700 UTC-2000 UTC, and 2200 UTC-0000 UTC. Frequencies: 3.840, 3.940, 7.090, 14.135, 14.290, 21.360, 28.990. For a certificate, send a 9" x 12" SASE with QSL to *VE3TXU Jim Bois, 55 Alexander St., Tottenham Ontario, Canada L0G 1W0.*

JUNE 4

PLYMOUTH, CT Radio amateurs in Plymouth will operate designated stations to celebrate the bicentennial of the Town of Plymouth. A limited number of special certificates are being made available by the Bicentennial Committee to commemorate the contact. Operation will be in the General portions of 160, 80. 40, 20, 15, and 10 meters as propagation allows. QSL with an SASE to *K1EM, P.O. Box 12, Pequabuck CT 06781 USA.* Include a shipping container large enough to hold the 9 1/4" x 13 3/4" certificate, or a No. 10 business envelope for a folded certificate; along with sufficient return postage.

JUNE 10

BROOKLYN, NY The Kings County ARC will operate WA2ZWP 1400Z-2300Z to commemorate the 170th Birthday of Fort Hamilton Army Base. Freq.: 3.943, 7.243, 14.343, 21.343, 28.343. For a certificate, send QSL and a 9" x 12" SASE to *Lenny Marinello KB2HQE, 2512 West 1st St., Brooklyn NY 11223.*

MT. CARMEL, IL The Radio Amateur Downstate IL Organization will operate Club Station WD9GTW 1700 UTC-2300 UTC, at the Old Time Radio Days 100th Anniversary of Meisner Radios. You will find them on the General phone subbands on 15, 20, and 40; 28490 on 10m and 146.940 Mt. Carmel Rptr. For a certificate, send SASE with QSL to *R.A.D.I.O., 827 Broadmoor, Mt. Carmel IL 62863.* For info, call *(618) 262-7111.*

MT. PLEASANT, IA The MT. Pleasant IA ARC will operate W0MME 1500Z-2200Z at the Heritage Boy Scout Camporee. Operation will be in the lower 50 kHz General class portion of the 80, 40, 20 meter phone bands. For a QSL, send SASE to *Dave Schneider WD0ENR, 1675 Old Hwy. 34, Mt. Pleasant IA 52641.* The Camporee will be sponsored by the Midwest Old Threshers and the Southeast Iowa Council of Boy Scouts.

JUNE 10-11

PIERRE, SD The Pierre ARC will operate AA0TS 1400Z June 10-0200Z June 11 from the State Capitol City, at the 66th annual South Dakota State Fire School. Phone operation will be at 3.940, 7.240, 14.240, 28.340, 145.350/.750. CW will be at 7.125. For a certificate, send QSL and a 9" x 12" SASE to *Pierre ARC, P.O. Box 1261, Pierre SD 57501.*

JUNE 11

FRANKLIN, NJ The Somerset County ARS will honor Guglielmo Marconi by holding a Special Event Day at Marconi Plaza in the Somerset section of Franklin Township. Station NW2P will be on the air 1300 UTC-2100 UTC (8 AM-4 PM local). Additional stations will operate at other Marconi sites: Cape Cod, Newfoundland, and England. Voice and CW: 15m Novice, 17m and 20m General, 2m and 6m SSB, 448.175(–) and 146.58 simplex. For a commemorative certificate, send your QSL card and a 9" x 12" SASE to *SCARS, P.O. Box 742, Manville NJ 08835.*

JUNE 17

LAPEER, MI The Lapeer County ARC will operate KG8CL 1200Z-0000Z, to commemorate the end of WWII. The Yankee Air Force and Dupont Airport are sponsoring this event. Operation will be on the lower portions of the General phone bands. Vintage gear of the era will be used on 40 meters. QSL via *LCARA, P.O. Box 46, Hadley MI 48440.* Please enclose an SASE.

JUNE 17-18

OAK PARK, MI The Oak Park ARC will celebrate the 50th Anniversary of the incorporation of the City of Oak Park MI by operating W8MB 1600Z-2400Z June 17th and 18th. SSB freq.: 7.280, 14.280, 21.380 and 28.480 MHz. For a certificate, send QSL card with SASE to *Oak Park ARC, 14300 Oak Park Blvd., Oak Park MI 48237.*

WESTON, WV The Central ARA, in conjunction with the Stonewall Jackson Lake Sport and Water Show, will operate KC8BK 1300Z-2000Z June 17th and 18th, to commemorate the 132nd Anniversary of West Virginia becoming the 35th State. Operations will be in the lower portion of the General 80 to 15 meter phone bands, and the 10 meter Novice phone subband. For a certificate, send a 9" x 12" SASE and QSL to *C.A.R.A.—KC8BK, P.O. Box 1487, Weston WV 26452.*

JUNE 28

KENO, OR The Keno ARC will operate WD6EAW 1600Z-0200Z as part of the ceremonies rededicating the Crater Lake Nat'l Park Lodge. This will commemorate the 80th Anniversary of the opening of the lodge. Crater Lake is the deepest lake in the U.S. Operation will be in the lower portion of the General 80, 40, 20, 15 and 10 meter subbands. For QSL, send an SASE to *Keno ARC, P.O. Box 653, Keno OR 97627.*

JUNE 30-JULY 4

OSHKOSH, WI Members of the Winnebago ARC will operate AA9GO 1600Z-0300Z June 30–July 4, to celebrate the 24th annual Sawdust Days Festival. Operation will be on the 80 to 10 meter bands. Send QSL and SASE #10 envelope to *AA9GO, Michael O. O'Connor, 519 Franklin St., Oshkosh WI 54901.* ■

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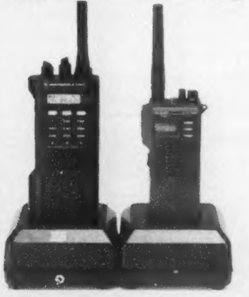

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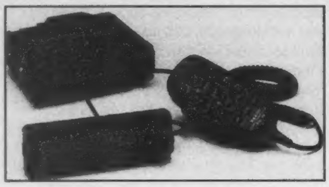
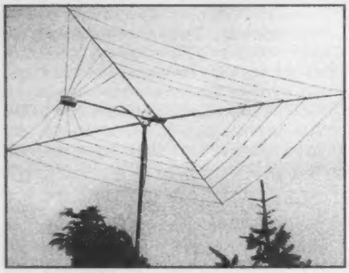


The FT-8500 from Yaesu is a deluxe compact FM mobile transceiver for both 2 meter and 70 cm operation. It includes two new features unique to this mobile: the FS-10 Smart Controller Microphone, and Spectra-Analyzer. For the first time ever, all radio functions are housed in the microphone. The FS-10 all-in-one Smart Controller Microphone permits total transceiver control from the palm of your hand. With its unique joystick-type lever, tuning and menu programming are now quick and straightforward.

Spectra-Analyzer allows you to view channel occupancy above and below your current operating frequency. A simple turn of the dial centers a signal of interest on the scope. Spectra-Analyzer also allows you to watch activity within your memory banks.

The FT-8500 is the first Yaesu mobile with a rear-panel data jack for packet. It has six-pin connections for data input, PTT, 9600 bps and 1200 bps receive data, squelch status, and ground.

For more information, contact *Yaesu USA, 17210 Edwards Road, Cerritos, CA 90703; (310) 404-2700*. Or circle Reader Service No. 206.



WB2GMK ANTENNAS

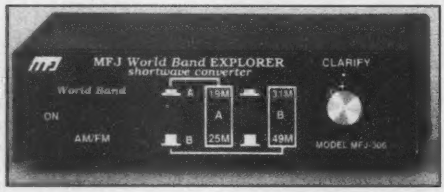
WB2GMK Antennas has announced the "CobWebb," a highly-efficient, limited space HF antenna designed by Steve Webb G3TPW, and manufactured by SRW Communications in Yorkshire, England. This antenna covers 14, 18, 21, 24 and 28 MHz with a square design only 8 feet on each side. It weighs only 14 lbs. (6 kg), so it mounts easily on a lightweight TV-type pole. Despite this ultra-compact design, the manufacturer's specifications indicate that the antenna functions at the same efficiency as a full-size, half-wave dipole on each band.

The CobWebb's horizontal polarization greatly minimizes RFI problems when compared to a vertical or vertically-polarized loop. Plus, it is extremely wide-banded on all bands, yet still exhibits a remarkable efficiency due to its exact match to 50-ohm coax. Its pure omnidirectional pattern, with virtually no nulls, makes it an excellent choice for DXing from small sections of real estate where larger arrays are impractical or not permitted.

The antenna will easily handle a full gallon and is rated to withstand 100 mph winds. It is extremely easy to assemble and install due to the use of Fiberglas spreaders and supports, as well as a preassembled feedbox and resonators.

The CobWebb is priced at $318 plus shipping. For more information, contact *WB2GMK Antennas, 2219 High Point Drive, Brandon, FL 33511; phone or fax (813) 653-3131*. Or circle Reader Service No. 201.

MFJ



MFJ Enterprises, Inc. has announced the MFJ-306 World Band Explorer Mobile Shortwave Converter, which allows you to visit the world while you drive. The MFJ-306 will convert your AM car radio into a world band shortwave receiver at the push of a button. Unlike local FM and AM radio stations that fade out after a few miles, the MFJ World Band Explorer will let you enjoy worldwide shortwave stations throughout an entire trip, day or night, providing programming that cannot be found on AM or FM radio, or even on cassette tapes. It will monitor the entire 19, 25, 31 and 49 meter international shortwave broadcast bands.

The World Band Explorer is very easy to install and use. It works on all car radios, even the newer digitally functional dials. It measures just 5 x 1-1/2 x 3-1/2 inches, and has a push-button to select world band reception or your AM/FM radio. And, it comes with MFJ's famous "No Matter What" one-year unconditional guarantee.

The MFJ-306 is priced at $79.95. For more information or to order, contact any MFJ dealer or *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; or call (601) 323-5869, fax (601) 323-6551, or order toll-free at (800) 647-1800*. Or circle Reader Service No. 203.

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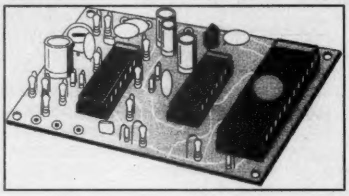
LogSat Software Corporation has formed a joint international business venture to develop, produce and distribute a commercial satellite tracking program called "LogSat Professional version 5.0 for Windows."

LogSat Professional allows both experienced and inexperienced computer owners to track thousands of satellites in dozens of Windows with all types of visual graphics. The program can be used by everyone from home-based owners with satellite dishes who want to watch overseas programs, to ham radio operators and professional ship/aircraft captains who rely on GPS tracking fixes.

For the price and more information, contact *LogSat Software Corporation, 425 S. Chickasaw Tr., Suite 103, Orlando, FL 32825; (800) 350-3871*. Or circle Reader Service No. 202.



Hamtronics

Hamtronics' new CWID-2 Module provides, in response to customer requests, just the CWID portion of the original CMOS COR-4 Module. The CWID-2 Module features small size, ease of assembly and maintenance, versatility, and a thorough manual that describes how to take advantage of all the available options. It uses all CMOS logic, operates on 7-15 V at only 3 mA, and is easy to fit into existing enclosures because of its small size (only 1-3/4 x 3-1/8 inches). The factory programmed EPROM saves assembly time and allows longer messages than the earlier diode-matrix type CWID module—enough room for up to 200 characters. The CWID-2 can also be set to repeat a message continuously for beacon operation.

The unit has adjustable output level, tone, speed, and interval timer. Installation is easy; the thorough manual describes how to adapt the CWID-2 for various applications.

For the price and more information, contact *Hamtronics, Inc., 65-F Moul Rd., Hilton, NY 14468-9535; (716) 392-9430, fax (716) 392-9420*. Or circle Reader Service No. 204.

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MultiFAX has announced Version 7 of the MFMAP software used with the MultiFAX WEFAX Image Capture System. This software is used to control the MultiFAX demodulator, as well as to capture and process (enhance, zoom, grid, colorize, etc.) the resulting satellite images. This new version, MFMAP7, sets the standard for power, speed and ease of use.

While retaining all of the functions of earlier versions, MFMAP7 contains the following new features: built-in satellite tracking, real-time on-screen output of the elevation and azimuth of the polar orbiting satellites, automatic computer controlled tracking capability (for use with the Kansas City Tracker), Record Level Meter with a graphical display of signal level, a new record option for NOAA satellites using the onboard crystal clock, easier image enhancement (using the new Palette Function), and MFREC and TIMER software to make unattended recording a snap.

MFMAP7 is priced at $49 plus S&H for MFMAP6 users; it is supplied with all new MultiFAX demodulator purchases after April 5, 1995. For more information, contact *MultiFAX, Route 1, Box 27, Peachland, NC 28133; (704) 272-9028, fax (704) 272-9036, BBS (716) 425-8759*. Or circle Reader Service No. 205.

XURON CORPORATION

XURON Corporation is offering a new catalog that includes a full line of specialty hand shears, flush cutters, wire cutters, pliers, crimpers and compact pneumatic cutters for industrial or electronic assembly and field service use. XURON's Timeless Engineering Catalog describes over 100 variations of ergonomically designed special purpose shears and flush cutters that feature XURON's patented Micro-Shear bypass technology, which provides a clean square cut using less force than conventional compression cutters.

Featuring product descriptions, dimensional drawings and full-color photographs, the 24-page catalog has a section that explains the ergonomic enhancements designed into the tools, such as cushioned rubber hand grips. Other products include solder resists, desoldering braid dispensers, tweezers and dispensing bottles.

The Timeless Engineering Catalog is available free from *XURON Corporation, 60 Industrial Park Rd., Saco, ME 04072; (207) 283-1401, fax: (207) 283-0594*. Or circle Reader Service No. 207.

Number 25 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, *73 Magazine,* 70 Rt. 202N, Peterborough NH 03458, and get set for the phone calls.

The deadline for the August 1995 classified ad section is June 8, 1995.

ALL ABOUT CRYSTAL SETS. Theory and construction of crystal set radios. $9.95 each, ppd USA. Send to: **ALLABOUT BOOKS**, Dept. S, P.O. Box 22366, San Diego CA 92192.
BNB200

HTX-202 & FT-11R Simplified manual for Radio Shack and Yeasu handhelds. Tired of looking up basic programming sequences? Simple instructions for the most used programming, step by step ($2 for the HTX-202.)($4 for the FT-11R) please send S.A.S.E. **Bill Andress (KC5HVV)**3603 Edgemont Dr. Orange, Texas. 77630 BNB220

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BNB235

1995 Nationwide Hamfest List & News Letter. $5 ppd.**"Hamfests '95"** Box 607, Hatboro, PA 19040
BNB245

ROMAC RADIO EXCHANGE, a revolutionary new computer on-line service for buying and selling amateur radio equipment. Why wait for weeks or even months to sell and buy equipment. Call today! Free until July 1, 1995. (300 to 14400 baud. 8/N/1.) **1-810-486-4878.** BNB260

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Number 26 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

Conditions This Month

June should prove to be a fairly good month for propagation on the HF bands, but you must consider three factors: time of year (noise from thunderstorms), low activity (summer solstice) and sunspot cycle (nearing the low point of cycle 22).

All is not lost, however, as June can be a superb month for VHF and also Sporadic E HF propagation.

For best DX chances, choose the days marked G (Good), F (Fair), or F-G/G-F (trending between these conditions), and avoid the days P (Poor) or VP (Very Poor) unless you're a gambler.

Interestingly, those Poor or Very Poor days on the HF bands can mean openings on 6 meters and above, so try them out when the HF bands are not producing results.

As always, there will be surprises, so listen, listen, listen . . .

10, 12, and 15 Meter Bands

Sporadic E propagation on many (G) or (F) days, with good signal strengths of short duration and quick fading. The ionized clouds drift with the high-altitude winds. Expect skip to 1,500 miles or so, and beam across the equator for possible contacts in the opposite hemisphere. These bands will close at sunset.

17 and 20 Meter Bands

Twenty will be best, and sometimes 17 will be almost as good, but not as heavily occupied. If open, the higher-frequency band will provide the longest skip. Twenty will remain open after sunset and sometimes late into the evening. Seventeen will close at dark or shortly after. Possible grey-line DX along the terminator is a bonus.

30 and 40 Meter Bands

Excellent nighttime possibilities on evenings when QRN is low and "conditions" are Good. Thunderstorms between you and your target can make copy difficult if not impossible. Daytime short skip out to 1,000 miles is frequent, and nighttime skip to 2,000 miles or more will occur less regularly. Thirty meters will behave more like 20, and 40 meters will behave more like 80 on many occasions, due to the height of the reflecting layer at that time. Always check the next-higher and next-lower bands.

80 and 160 Meter Bands

Expect lots of QRN. You'll hear very few signals on 80 during the day, and none on 160. These bands are the nighttime bands in summer, and it pays you to keep a sharp ear open after sundown. On particularly good nights with low noise, you will find both long skip and DX on both bands. Avid DXers must be patient, however, because in summer there's almost always noise present. I'd recommend that you use the long summer days and evenings for building up better antennas for these bands, and wait until fall for conditions to improve.

Special Alert

Beware the days 1-3, 6, 7, and 18-21 for possible geophysical upsets. These could include hurricanes, earthquakes, or volcanic eruptions. These won't necessarily happen, but if they do, they will occur on or very close to those days.

Please let me know how these forecasts are working for you at your location. W1XU.

JUNE 1995

SUN	MON	TUE	WED	THU	FRI	SAT
				1 P	2 P-F	3 F
4 F-P	5 F-P	6 P	7 P	8 P-F	9 F	10 F
11 F-G	12 G	13 G	14 G-F	15 F-G	16 F	17 F-G
18 F-P	19 F-P	20 P-F	21 F	22 F-G	23 F-G	24 F
25 F-P	26 P-F	27 F	28 F-P	29 F-G	30 G	

EASTERN UNITED STATES TO:

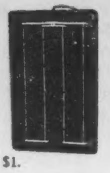
GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WESTCOAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		



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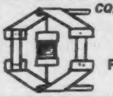

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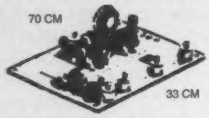

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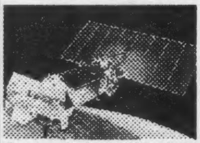

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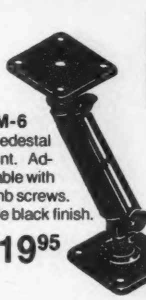
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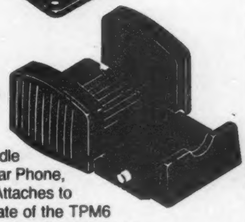
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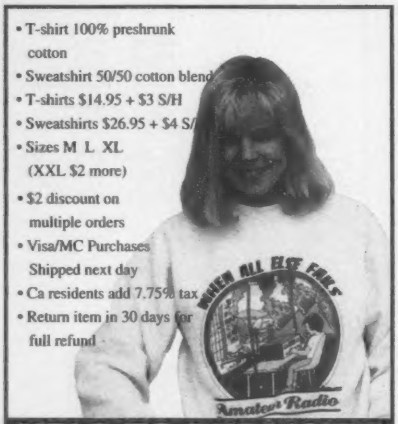
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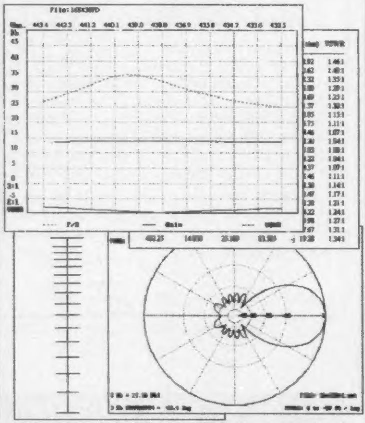

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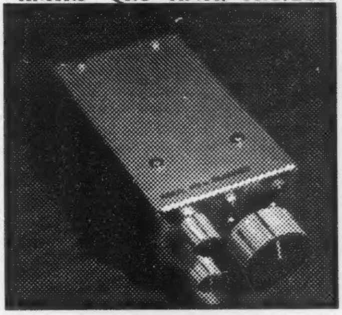

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This device has not been approved by the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased, until approval of the FCC has been obtained.

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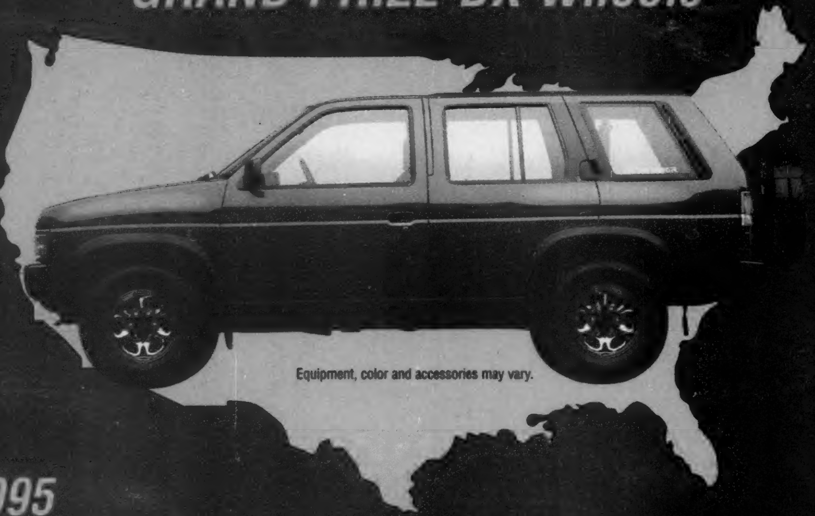

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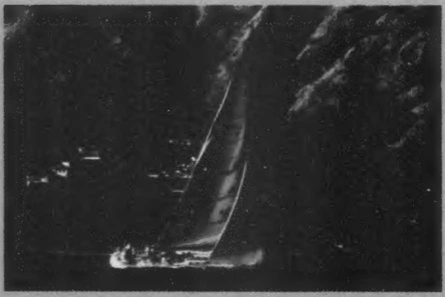

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